JOURNAL OF GAS LIGHTING & WATER SUPPLY.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXXXII., No. 2744.] TUESDAY, DECEMBER 14, 1915. [67TH YEAR.

EDITORIAL NOTES.

The Unwelcome Naphthalene Revival.

THE revival of the naphthalene trouble as an uncomfortable accompaniment of the introduction of the gas-washing process for the extraction of benzol, toluol, &c., was referred to in the first editorial in the "JOURNAL" for Oct. 26. In a short pithy article given in our columns to-day, Mr. Thomas Glover, of Norwich, discusses the main causes of the fresh appearance, and the methods of obtaining relief from the deposition of the substance. In another article a simple form of petroleum vaporizer is described, which can be promptly introduced, and the effectiveness of which in producing relief is well attested, while the proportion of petroleum required to the gas to be treated is stated to be very moderate indeed.

The discussion of the subject by Mr. Glover reminds of the old difficulties, the old controversies, and the old beliefs and doubts. The best accepted view of former days as to the causes of the formation of naphthalene was that it was due to light charges, high heats, the large vacant space at the top of the retorts, and the exposure of the gaseous products to the radiant heat and the incandescent surfaces. But there were a few who were sceptical as to the validity of this explanation; and yet the proof then lay ready at hand, if anyone had been wise enough to make use of it. Proof is often furnished as to exact causes by the results of producing diametrically opposite conditions. When heavy charges came, when the vacant space at the top of retorts was practically filled up, and when the exposure of the gas to the old deteriorating conditions was reduced, naphthalene troubles ceased, and a distinct difference was found in both tar and gas. As Mr. Glover points out, the tar from light eight-hour charges yielded upon distillation 4 per cent. by volume of light oils; and the naphthalene content of the products of distillation was at the maximum. The tar from heavy twelve-hour charges yields 22½ per cent. of light oils; the naphthalene content of the distillation products being at the minimum. Of course, these percentages are only approximate, and will vary with the character of the coal and the conditions of carbonization; but the two generally stated facts point to several things, and elucidate much that in the old days was somewhat puzzling.

However, even in places where heavy charges are worked, there has been, with the application of the "C" process, a recurrence of naphthalene troubles; and it is greater still where light charges remain the practice. It is clear too that, generally speaking, the trouble has been revived by the constitutional differences in the gas due to the application of the washing process. Though under what may be termed normal conditions—that is to say, if the tar is not supersaturated with naphthalene vapour, and the temperature conditions under which the washing proceeds are right—there should be, and will be, through the washing process, a reduction in the naphthalene content of the gas, still what remains has, with changed temperature conditions, given much trouble. Of course, if the tar used for washing is supersaturated with naphthalene vapour, or the temperature conditions are not correct (as Mr. Glover puts it, the capacity of tar to absorb naphthalene and naphthas increases as the temperature falls, and decreases as the temperature rises), it may well happen that the gas will become more heavily charged with naphthalene than it was before being submitted to the process; and this too would account for current experiences.

However, there is the fact of the deposition of naphthalene, and the return of the old trouble. The question is how to deal with it. Toluol recovery cannot be stayed; it must go on—it is a national necessity—and so the difficulty must be faced in one of two ways, as suggested by Mr. Glover. Either by washing the gas (after the operation of the "C" process) with water-gas tar containing a large proportion of low boiling fractions to reduce the naphthalene, and at the same time compensate for the previous extraction of naphtha vapours, and so prevent deposition, or to vaporize into the gas ordinary petroleum. With the apparatus described in the second article, the use of about 20 gallons of petroleum per million cubic feet of gas is found effective; but the proportion of petroleum can be reduced after the depositions have been cleared from the mains. The subject is a live one at the present time, and to an extent that is not agreeable. But the fact will ensure interest in the contributions appearing in the "JOURNAL" to-day.

Pooling Private Railway Waggons.

THE congestion on the railways and the scarcity of rolling stock under the circumstances of the war have been matters of the deepest concern and difficulty, and have occasioned super-expense, to those engaged in industry—such as gas-works—dependent on the railways for their supplies of raw material and manufactured goods. The congestion and the shortage are largely due to movement of troops, to the ever-increasing transit of munitions and other goods requisite to the prosecution of the war, to the enlistment of railway-men, and to (good authority asserts) improper organization of available resources. Whatever the causes of indifferent and delayed deliveries, the effects upon industry are uneconomic. Among the proposals for ameliorating the conditions is that of the pooling of private railway waggons. The idea has been raised several times; and now, at a private conference held the other day at the Board of Trade, it appears that a pooling scheme was put forward, including privately owned waggons, as though it had been practically accepted, and was now only awaiting the shaping of the conditions to carry it out—in fact, the scheme, it is stated, has gone so far that it has been decided to pay 6 per cent. on the capital invested, as remuneration for the use of waggons. There is alarm over the situation among private owners of waggons, and protests are falling all round. Of course, in such times as these, one cannot but affirm the general proposition that, where necessary, private interests must be temporarily set aside, if thereby national interests can be served. Colliers, merchant, and other vessels were, in the national interests, commandeered at the beginning of the war and since by the Government, and at their own price. Through the public and shop lighting restrictions, the interests of gas and electricity suppliers have been rightly set on one side in the national interests. The hours during which the sale of alcoholic liquors is permitted have in London and many other areas been reduced—all in the national interests.

Illustration could be extended. But such precedent ought not to govern every proposal that is made. It may be that some things that are put forward for national advantage may bring such mischief in their train that, on balance, they may prove a national disadvantage. We do not say this is so in connection with the question of the pooling of private railway waggons; we should like to hear all sides before arriving at any positive determination. But it does seem to us that there are considerations affecting the proposal that are of such material character that they should be taken into account. One is as to whether the winter is (if this is the intention) a suitable time to introduce a pooling or appropriation scheme for private waggons To introduce it now would dislocate existing arrangements just at the height of greatest pressure. A scheme of the kind should assuredly be carried out at a period when goods traffic is the lightest, and that is in the summer time—at any rate, it is so with coal traffic. If the pooling of all privately owned railway waggons is an imperative necessity in the national interests, then, had the scheme been put through last summer, it would have been in working order by now. The Board of Trade recognized quite well months ago that there would

be trouble on the railways this coming winter, seeing that they particularly urged large users of coal and even householders to take the precaution of filling their coal stores and cellars. Another point is that many contractors have their own railway waggons; and their current contracts are based upon this ownership, and an exact knowledge as to the cost of delivery. A further point is that it seems wholly unfair that, for example, those gas undertakings that have made provision of railway waggons of their own should suffer so as to benefit other undertakings that enjoy equal circumstances, but have not made like provision. On the other hand, we sympathize with those concerns whose conditions are not such that they could become waggon owners on their own account. A still further point that occurs offhand is that some gas undertakings have had their coal-stores specially built with elevated lines, and they or their contractors have provided (say) twenty-ton railway waggons with bottom discharge in order to facilitate delivery. Unless such works, in any pooling scheme, are assured of waggons that will render them equally good service, they will be at a disadvantage which will not be covered by a 6 per cent. payment on the capital invested in the waggons.

It is evident that the pooling scheme, if there is any real intention of carrying it out—and many important owners of private waggons think such an intention has already taken almost definite shape—requires examining very carefully all round, so that serious injustice shall not be done. The commandeering of colliers is not exactly analogous. All colliers were not commandeered; and the object was the coaling of the nation's Navy. It is proposed to pool all private railway waggons; and the object is the benefit of all and sundry who do not possess waggons of their own, while those whose circumstances permit, and who have been wise enough to become possessed of waggons, will find themselves at a decided disadvantage as participants in a common user.

The foregoing was in type, when, from Mr. J. Ferguson Bell, there was received a letter (which is reproduced in our "Correspondence" columns to-day) in which he urges that all gas undertakings that are interested in this question of private waggon pooling should immediately write a letter to the Secretary of the Railway Department of the Board of Trade, emphatically protesting against the project. As we have said, the present is an exceptional time for goods traffic; but we cannot forget that the question of the sufficiency of railway waggons is not a new one—it anteceded the war by years. The Railway Companies neglected to provide an ample supply of waggons for mineral and other traffic; and the deficiency was largely made up by the expenditure of private capital—for the express purpose of obtaining all the facilities and economies of ownership. The Association of Private Owners of Railway Rolling Stock has a membership possessing between 500,000 and 600,000 waggons; and had it not been for these private waggons, the country would have been, in respect of its goods distributing capacity, in an infinitely worse position than it is at this time of pressure. The country therefore indirectly owes a great deal to the private owners; and it would be poor recompense to deprive them of a convenience of which they are possessed through their own enterprise at a period when the convenience is most urgently needed.

The Defeat of the Kitchen Coal-Range.

All practical experience is valuable; and within experience of the kind come the contents of the paper which Mr. W. L. Westbrook, of the North Middlesex Gas Company, read before the London and Southern District Junior Association on Friday last. Not a great while ago, the coal merchants, who were beginning to feel acutely the inroads of gas heating upon their business, and the growing appreciation of the public of the handiness and efficiency of gas methods, circularized London pointing out all sorts of things adverse to the use of gas, and favourable to the continuance of the use of coal, which were egregiously contrary to fact. The clumsy attempt to stop progress, and to set the public against the lessons of practical experience, fell very flat. Nobody heeded what was recognized as a note of alarm by interested persons; and the change from old methods to new continues uninterruptedly. Among domestic heating equipment, the kitchen coal-range is by far the most voracious. Dampers notwithstanding, there is a propensity to so "regulate" them that the fire in the range is constantly on the "roar;" and consequently British thermal units make speedy flight up the chimney, and the waste is enormous. Kitchen ranges, too, are terrible sinners in the contribution they make to intensifying, in residential areas, when conditions are favourable, the murkiness of the atmosphere. It has, however, been admitted by those who make a study of atmospheric conditions that the gas industry has done much in the cause of atmospheric sanitation by what it has effected, through gas cooking, in putting the coal-range out of constant use. At the same time, they are convinced that, while the chimneys of industrial establishments have, despite legislation, a bad reputation as defilers of the atmosphere, the myriads of domestic chimneys in the aggregate far exceed the crime of, and the grime occasioned by, the factory chimney. But though there are occasionally threats that something will be done to bring domestic chimneys under control, there is a decided disinclination, on the part of the powers that be, to intrude upon the prescriptive rights of the householder, though in the exercise of those rights contribution is made to something that is distinctly noxious, and a general nuisance. The fight against the pollution caused by the domestic chimney must therefore continue to be largely a local one, through educational means, through the force of example, and through persistent work on the part of those who have something which can displace heating by coal, without in most operations increasing the cost, and which has the advantages of reducing labour, and of possessing efficiency and the convenience of ever-readiness.

While the gas-cooker has taken a large part in improving matters, unfortunately, standing alone, it does not do all that the kitchen coal-range can do, but with an "efficiency" that is an abomination in the eyes of those who are preaching the gospel of fuel economy. We have therefore alternations of use between the gas-cooker and the kitchen coal-range. But Mr. Westbrook tells us that this is not necessary, and proves the submission by practical experience in the district of the North Middlesex Gas Company—at all events, so far as those people are concerned who can afford to convert their kitchens from coal heating to an entire gas-heating system, and, by doing so, purchase convenience and save labour. What has been done in this respect must weigh with architects, who will find that the attractions of the houses they erect will be augmented by the adoption of a combination gas-heated system in the kitchen, in place of the cumbersome and slow-operating coal-heated range. Where the combination gas system is put into houses as erected, of course the expense is not so great as when a coal-heated range must be removed, its habitation tiled and fitted for the reception of the gas-heated successors, and the necessary gas supplies laid on, and the water-circulating system adapted to the new mode. The kitchen combination adopted in the North Middlesex district consists of cooker, water-circulating boiler with thermostatic control, and a fire for general heating purposes. In two years, the Company have made eleven such installations—four in new houses, and seven in houses from which the coal-ranges have been evicted. In addition, about fifty coal-ranges have been put out of action by fixing a gas-fire in front of the fire-bars, or otherwise sealing-up the front. It is from the experience gained in displacing these coal-ranges, and in installing gas-heated arrangements, that Mr. Westbrook's paper is composed. In it there is information of both technical and commercial value, and actual data as to comparative costs, which should be serviceable to other gas undertakings in prosecuting the work of kitchen conversion from crude to scientific heating methods.

We will pass over the particulars contained in the paper as to the modes of installation, and the limited troubles that have been met with and easily rectified, in order to direct special attention to the comparative financial statements under the *régime* of coal heating and under that of gas heating. Part of the value of these actual and not theoretical figures lies in the fact that they are from houses of varied rental and domestic conditions. Yet they all tell the same tale: That using gas entirely for cooking, the supply of hot water, and heating the kitchen, the costs of the two systems, taking the year through, are extraordinarily proximate, and this without assessing certain financial savings, or taking into account the reduction in the number of servants in the larger houses, and the convenience, the availability, and the comfort which the change has introduced. In making similar comparisons, our electrical competitors succeed in showing savings by taking credit for the wages and "maintenance" of (say) one or two discharged servants;

but Mr. Westbrook has no occasion to do anything of the kind. His comparisons, drawn from actual practical experience, stand favourable to gas as against coal heating without taking credit for any effects external to the work required of the cooker, the circulating-boiler, and the fire. The pulling out of the old range, and preparing and tiling the recess for the new gas-heated tenants, cost from £4 to £5; and, including this and the new appliances and all fitting work, the total cost amounts to £19 14s. If the house is a new one, and there is no pulling-out and alterations to be made, the total cost is a couple of guineas less. These figures, of course, are subject to the described conditions; variations from which may cause differences in cost. If a 3 ft. 6 in. coal-range requires renewing, the cost is something like £10 to £12; and the difference between this and the £19 14s. is, as is shown, money well spent.

Now in comparing working costs, it will be noted that gas is charged at 3s. per 1000 cubic feet; so that where the price is lower in normal times, the financial advantage alone of complete gas heating in the kitchen will be greater, seeing that 30s. per ton is not of late years an uncommon price to pay for a good house coal. Another point which will be remarked is the considerable addition to annual gas consumption that the transfer from coal heating has made. In the smallest house referred to, the increase in the gas account amounted to £3 3s. 11d. in one year after the gas combination was established; but *per contra* 2 tons of coal less were used, which meant £3, and £1 is estimated as the saving in repairs to boiler, and costs of sweep and wood for fire lighting. These two items total to £4; so that 16s. 1d. was actually saved. The succeeding illustrations are drawn from larger property. In the second example, the addition to the gas account was £13 1s. 7d.; but the house was relieved of the dirt and labour occasioned by the delivery and use of 8½ tons of coal, which gave a saving of £12 15s. in the coal bill. The extra cost of gas was therefore 6s. 7d. above the coal bill, without taking credit for the savings in boiler repairs, sweep, wood, &c. In this instance, two servants have been dispensed with since the gas combination was installed; and this represents a considerable gain in the household economy. It is only fair, however, to say that the gas combination has been under constant supervision, while there was extravagance in the use of coal when servants were in full control. Passing to the fourth example in the paper, the testimony there to the capacity of gas for effecting economy is remarkable. In this case, the house has been converted wholly to gas heating. The extra payment for gas amounted to £15 7s. 5d. a year; while in 1913, the quantity of coal used cost £24. The difference between these two figures, representing saving, is £8 12s. 7d.; and this without taking credit for boiler repairs, sweep, and wood, and the wages and maintenance of two servants for whom sufficient employment could not be found. This householder also obtained the full discount allowed by the Company under special circumstances—that is to say, where gas is used exclusively for hot water supply and cooking, a discount of 10 per cent. is granted, and, where gas-fires are also fixed in every grate, the discount is 15 per cent. It was therefore the latter discount that he enjoyed.

Here we have merely extracted a few salient figures from the many given by Mr. Westbrook; but, from the quoted few, it will be seen that the adoption of a complete gas-heated system in the kitchen produces excellent mutual advantages for gas company and consumer. The paper will, we are sure, act as an incentive to similar work being taken up in other residential areas.

The "Journal" and the Sliding-Scale.

After the unswerving and strong support accorded by the "Journal" to the sliding-scale of price and dividend as a healthy and fair method of regulating the conditions of gas supply as between consumers and gas companies, it is interesting, and almost amusing, to have Mr. Charles Hunt, in the year 1915—forty years after the birth of the sliding-scale in its application to gas supply—making the following remarks regarding our attitude towards it in that celebrated year for the gas industry, 1875. "The 'Journal of Gas "Lighting,'" he writes, "designated him [Mr. George "Livesey] Mr. Forster's 'guide, philosopher, and friend'— "words which, although they *may have been* 'wrote sarcastic' "—for the 'Journal' was strongly opposed to the innova- "tion of the sliding-scale—could hardly have been far from "the truth." The validity of the insinuations that some of the words quoted may have been "wrote sarcastic" and that the "Journal" was "strongly opposed" to the innovation of the sliding-scale, can only be tested by the general lines of the comments, and by the literal meaning of the words then used, as the writer of the criticisms of those days is beyond the pale of personal reference.

In considering the attitude of the "Journal" in those days, the conditions of the times as affecting gas companies should be taken into account; and, reading to-day the editorial remarks, it is quite clear they were more directed against the terms of the sliding-scale as applying generally to the conditions of those times than against the "innova- "tion." The fixed initial price proposed in 1875 was the point that aroused the so-called strong hostility; and, in connection with it, the "Journal" proposed what has since been adopted by some undertakings—a neutral zone of price and dividend. Let us quote from an editorial published on June 8, 1875, for the double purpose of refreshing Mr. Hunt's memory, and of clearing away any notion that his published statement may have spread that there was at one time a sort of ferocious antagonism on our part to the sliding-scale, which has since operated so beneficially for both gas consumers and gas suppliers:

> The initial price is indeed a most important matter. We are not legislating for to-day; but, let us hope, for years to come. The price of 3s. 9d. *may be sufficient for to-day*, but who can guarantee us against a recurrence of the events of the past three years. We reiterate our opinion that 3s. 9d. is *an utterly insufficient price*, if the companies are to be fined for exceeding it. The question of initial price is really the cardinal point in the Bill. The Board of Trade, adopting our suggestion of an up-and-down sliding-scale, plainly propose the price of the Act of 1860 as the initial price. We have before proposed this price; and we now suggest that the downward scale of dividend should not commence until 4s. 6d. be exceeded, and that the upward scale should not begin unless the price is less than 3s. We believe this would be fair to all the companies, and would place them all pretty nearly on an equality.

Does this look like any intention of being strongly opposed to the "innovation of the sliding-scale?" A week later, in an editorial, we have these words:

> We gather from the speech of Sir E. Beckett that the "associated companies" object to any sort of sliding-scale of dividend; and so, in fact, do we. We only support the up-and-down scale as a simple measure of fairness. If a company are to be fined, for that is what it practically comes to, when they exceed one price, it is but just that they should be rewarded when they make another and lower charge.

In other issues, the editorial references all indicate that, so far as the "Journal" was concerned, the conditions—particularly that as to the initial price—were the ground of antagonism, and not the principle of the sliding-scale. It was "supported" as "a simple measure of fairness." There is a great deal of difference between opposition to a principle, and opposition to the conditions that may be applied in the exercise of the principle.

Now we are wondering why it is Mr. Charles Hunt has seen fit in December, 1915, after the long loyalty of the "Journal" to the principle of the sliding-scale, to suggest that at one time we were "strongly opposed" to it. Perhaps he will now try to reconcile the statements we have brought to light from the past with his own deliberate assertion to-day. The unqualified charge does not in any way harm us; our only care is historical accuracy.

A Great Labour Combine.

A step was taken last week which creates the greatest labour combine that this country has ever known, and the power of which for mischief to the national interests is beyond estimate. The Executives of the Miners' Federation of Great Britain, the National Union of Railwaymen, and the National Transport Workers' Federation, adopted a scheme by which these three powerful bodies agree, under certain conditions, to throw their combined weight into offensive and defensive movements in the interests of wages and the conditions of labour in the coal-mining and carrying industries. By the rules that were agreed to, it is, among other things, provided that matters submitted to the joint body, and on which action may be taken, should be those of a national character, or vitally affecting a principle which, in the opinion of the executive making the request, necessitates combined action. Then it is arranged that co-operation of the joint organization shall not be called for until the matter in dispute has been considered by, and received the endorsement of, the national executive of the organization primarily concerned, and any of the

organizations instituting a movement likely to involve the other affiliated organizations is, before any definite steps are taken, to submit the whole matter to the joint body for consideration. But joint action can only be taken when the question at issue has been before the members of the three organizations, and decided by such methods as the constitution of each organization provides, after which a conference is to be called without delay to decide and consider the question of taking action. It is believed by the unions concerned that this alliance will prove the most effective weapon, when peace is restored, for defending existing wages, and maintaining the war bonus, which it is considered should be made a permanent addition to wages. It looks as though when international peace comes, there are likely to be troublous times at home with labour; and in what happens this new and powerful combine will take a leading part.

The Safety of Miners.

As the result of their extensive researches, the Explosions in Mines Committee some time ago arrived at the conclusion that the use, in specified quantities and in a suitable manner, of incombustible dust will greatly diminish the number of explosions in mines, and limit their violence, though the experiments do not permit the Committee to say that the treatment will render such explosions impossible. But having decided that the use of incombustible dust would be beneficial from one point of view, the Committee found themselves faced with the question of whether the scattering of considerable quantities of fine dust in a mine might not prove dangerous to the health of persons engaged in work there. The elucidation of this part of the subject was entrusted to Dr. J. S. Haldane, F.R.S., whose conclusions are embodied in the recently issued seventh report of the Committee. The preceding six reports were devoted to experiments, already referred to, upon the effects of inert dust in preventing or limiting explosions. The dust of free silica has long been known to be more or less dangerous; but the result of Dr. Haldane's investigation is to fully confirm the conclusion already arrived at by Professor Beattie, that dust of argillaceous shale, such as is found interstratified in the coal measures in most mines of the United Kingdom, though it contains silica, is not in the least likely to prove a danger to health. On the other hand, he finds ground for suspecting that flue dust—also being employed for stone-dusting in coal mines—may have injurious effects; and he advises that its use should be discontinued. The report shows that the researches have been carried out in a manner which fully justifies acceptance of the statements that, both from human experience in coal mines and from experiments on animals, there is clear evidence that shale dust when inhaled is no more deleterious than coal dust; but that it is desirable, from the point of view of health, to reduce as far as practicable the inhalation of any kind of dust in mines. In connection, however, with the discussion of this question of safety in mines, it may be pointed out that the very first table in the report proves, as Dr. Haldane says, that coal-mining is at present one of the relatively healthy occupations.

Companies of Enemy Character.

Those who have concerned themselves with what is undoubtedly a very difficult problem on the industrial side of the war, will have noticed that a Bill has been introduced into the House of Lords by the Earl of Halsbury, with the object of making provision with respect to companies of enemy character; and they will probably also have seen, many with regret, that on the occasion of the second reading of the measure, the Lord Chancellor, while expressing agreement with its principle, said he feared there was little prospect of the Bill becoming law. Its intention is to provide that, where it shall appear to the Attorney-General that any company registered in the United Kingdom is, owing to the character of its directors or shareholders, or to any other cause, of a predominating enemy character, he shall present a petition to His Majesty in Council praying that it may be declared to be an enemy company. Any officer or shareholder of the company, not being an enemy, may raise an objection, and be heard before the Judicial Committee of the Privy Council; and if the Judicial Committee shall report that the company is of a predominating enemy character, it may be declared to be an enemy company, "and any ship belonging to such company shall forthwith become the property of His Majesty the King." Such a company shall during the present war be deemed to be an enemy; and all such disabilities and other consequences, whether at common law or under any Royal Proclamation or Statute, shall attach to the company and its property and dealings, as if it were a company incorporated and carrying on business in an enemy country. The name of the company shall not be removed from the register; but it shall be notified therein that the concern has been declared an enemy company. All branches of an enemy company shall be treated as of an enemy character, and all transactions by or with any such branch as transactions by or with an enemy. On the reading of the Bill a second time in the Upper House, the Lord Chancellor admitted that the majority of the Court of Appeal have decided that, if seven or more people, all enemy aliens, have joined themselves together and incorporated a company in this country, they have by that means created an entity which is not German in its character. As, however, the case in which this judgment was given is to be carried to the House of Lords, he suggested that the Bill might be held-up pending the result of the appeal.

OBITUARY.

The death occurred last Tuesday, at the age of 64 years, of Mr. DAVID WOOD, the Secretary and Manager of the East Hull Gas Company. Deceased was the oldest servant of the Company, having been in their employment for 38 years. He leaves a widow and two daughters.

In connection with electricity, Mr. THOMAS PARKER, who died at Ironbridge on the 5th inst., had many successes to his credit; but so far as the gas industry is concerned, he was less fortunate. Born in 1843, he began work at a very early age at Coalbrookdale, and in 1882, in partnership with Mr. P. B. Elwell, established an accumulator and dynamo business in Wolverhampton. Subsequently, he did much work in electric traction; his principal scheme being the electrification of the Metropolitan Railway. His inventions were numerous, and not confined to one field. In 1880, he obtained a medal at the London Smoke Abatement Exhibition for one of the first slow-combustion stoves introduced. Then came the patents—which, unfortunately, so many investors have had cause to regret ever having become acquainted with—for the production of "Coalite," by the partial distillation of coal at a low temperature. The controversy which the proposals aroused must be still fresh in the minds of most gas men.

PERSONAL.

Consequent upon the death of Mr. C. W. Boyns, the Secretary and Manager of the Romford Gas Company, Limited, Mr. J. C. WRIGHT (the Engineer) has been appointed Engineer and Manager; Mr. GEORGE BERRIDGE (at present Accountant and Assistant Secretary at the Kettering Gas-Works) has been selected to fill the position of Secretary; and Mr. D. HAYES (who has for the past ten years been with the Romford Company) is promoted to the post of Assistant Secretary.

By a mutual arrangement, Mr. E. J. WELLENS has been able earlier than was expected to leave Hebden Bridge and take up his new post as the Works Manager at the Grimesthorpe station of the Sheffield Gas Company. His successor at Hebden Bridge, Mr. T. H. NIELD, has also "got into harness." Before Mr. Wellens left, the workmen at Hebden Bridge presented him with a neat silver spirit kettle, appropriately inscribed. At this pleasing ceremony Mr. Nield presided; and the gift was handed over by Mr. W. Wilkinson, the oldest employee on the works.

Mr. Alexander's Retirement.—In the "JOURNAL" for Nov. 30, p. 477, reference was made to the retirement of Mr. Alfred J. Alexander from the secretaryship of the Bristol Water-Works Company (after having occupied the position for upwards of 46 years) and his acceptance of a seat on the Board. The "Bristol Times and Mirror" referring to the matter remarks: "This is an announcement of peculiar interest, for Mr. Alexander is one of the best-known men in Bristol, and his services to the Water Company as Secretary and General Manager have been not only of remarkable length, but of inestimable value. Mr. Alexander has seen the Company grow to its present splendid position as one of the first water companies in the country; and he has done much to promote the development. It is no secret that the success of his work brought him years ago tempting offers from other large water companies. Mr. Alexander combines in a happy way exceptional business capacity with perfect courtesy. His co-Directors and the shareholders generally are to be congratulated on the fact that his knowledge and ability are retained by his acceptance of a seat on the Board."

The December issue of "A Thousand-and-One Uses for Gas" (published by the British Commercial Gas Association) is a wholesale drapers' number, and contains special articles upon gas appliances in the textile trades, gas in the textile factories of Bradford, and the effect of gas lighting on coloured fabrics.

ELECTRICITY SUPPLY MEMORANDA.

Lighting of Artizan Dwellings.

THE lighting of workmen's dwellings has the same attraction for some electricians as a light has for moths; but like the moths several electricians have seriously "singed their wings" over the schemes they have adopted. Many trials have had to be scrapped; or, if not scrapped, they have not led to an extension of permanent business. With all the distortion of figures, electricians cannot get away from the fact that the consumer who in the scale of opulence is located at the bottom, cannot have the same illumination from electricity as from gas for a given price, if the price is one showing a real profit to the undertaking. Moreover, it is not lighting only that the working-class consumer needs to get through his gas-meter. He has realized that he lives in a labour-saving age; and although his trade union may object to labour-saving machinery on the works or in the factory, the working man does not object to the introduction of labour-saving and convenient appliances into his home. He therefore wants his gas-cooker or his gas-ring and griller; and he likes the idea of a mono-supply for lighting, baking, grilling, and boiling, all through one meter. There is a convenience in this to the man of limited means; and with this convenience the electricity industry realizes its incapacity to economically supply him. There is the Fixed Price Light Company. That piece of enterprise does not appear to be doing anything very startling, judging by the rare mention that is made of the Company and its work. We do not remember that the accounts of the Company have ever been published in the electrical papers; and how the shareholders are faring is a matter known only to those interested in the concern, and those who are favoured by their confidence. The "Electrician" has been trying in an editorial to boost-up the subject of the lighting of artizan dwellings. An article in its columns by Mr. J. Cleary on an experience at Brighton has called the editorial pen into action. It is pointed out that the metallic filament lamp has altered the conditions, and made a lighting supply practicable, for workmen's cottages and flats. In the days of the carbon filament lamp, the extra charge that had to be made for "free" installation supplies turned the electric light into a veritable luxury. Now the lower consumption metallic filament lamps have altered the position of affairs. The amount of energy used is so much less that, it is said, a substantial additional charge can be made for the installation, and, even so, says the Electrical Editor, the cost of electric lighting will compare favourably with the cost of gas lighting. We should like to be associated with the Editor of our contemporary in a running test, with meters and photometers, if he chooses to take it on, and will publish the result in his paper—the same as we shall be pleased to do.

Gas and Redecorations.

According to Mr. Cleary, the gas industry is in for a very bad time if every electrical engineer does his duty. He writes: "Until such facilities are given that the electric light may find its way into the house of every artizan, it cannot be said that the electrical engineer has fulfilled his mission." So that, when this mission has been fulfilled, the gas industry will find itself without any lighting business. Mr. John Christie, of Brighton, it appears from the article, has started on this mission by supplying electric light to a number of artizan dwellings and flats—very properly the property of the Corporation; and the experiences with this work supply Mr. Cleary with the material for his article. The reason assigned for making the change in the lighting has to do with redecoration. Mr. Cleary makes some statements concerning the wickedness of gas in respect of the destruction of decorations, the impeccability of the electric light, and the fearful cost that gas occasions, as though houses never require redecorating through other causes than gas lighting. He says that the owners of small property are kindly disposed to the change to electric lighting, as they now realize that by this means, they can "overcome" the annual tax of about 20 per cent. upon the revenue of their property for redecorating. Then, again, Mr. Cleary loosely tells us that an estate agent dealing in weekly properties, whose payments for redecorating due to gas discoloration, "&c.," amounted to upwards of £2000 per annum, has found a remedy in the electric light. We are not told what the "&c." covers. Then a couple of years ago the Health Committee of the Brighton Corporation, in their annual report, stated

THE "JOURNAL" SUBSCRIPTION RATE AND NATIONAL FINANCE.

Until the Budget was presented last September, it had never occurred to us that national fiscal conditions would interfere with the subscription rates that have existed for the "JOURNAL" over the long period of 42 years. But what was never contemplated, nor even dreamed of, has come to pass. Under the Post Office and Telegraph Act, 1915, which became operative on Nov. 1, what we must confess has been a low rate of postage within the United Kingdom for a paper such as the "JOURNAL" has been revised (with, of course, the object of increasing the country's revenue from this source); and now the cost of transmission through the post is to be ½d. for every six ounces, or part of six ounces. Under the circumstances, unless the "JOURNAL" was reduced to a skeleton of its own self, by diminishing the quality of the paper (which would make it less suitable for binding and preservation), and unless the articles, reports of meetings, and the general intelligence were cut down to a length which would seriously detract from the reputation enjoyed for completeness of record of the affairs of the gas industry over the past sixty-seven years, it would be impossible to bring it within the weight which can, under the new order of things for newspapers, pass through the post at ½d.

Simultaneously with the increase in the rate of postage, the cost of paper and printing has (as in the case of all other commodities and work) been seriously augmented. This, even without the additional postage, might be a reason for reducing quality in order to economize. But there is no intention of taking any such course, nor, on account of the extra cost of production, of asking for an increase of subscription. But it is only fair that subscribers should share the burden of extra costs by paying the additional postage; and we are perfectly certain no one will object to this. The extra postage, assuming all issues were of normal size, would be 2s. 2d. a year; but there are occasionally numbers that exceed even 12 oz. in weight, and the postage of which will cost more than 1d.—for instance, the transmission from office to home subscriber of the Institution number for 1914 would, under the new postal charges, have cost 3d. per copy. Under the circumstances, we are adding 2s. 6d. to the prepaid annual subscription—making it 23s. 6d., and to subscribers who prefer making prepayment half-yearly, the rate will be 12s.

No apology is needed for a change in the terms of subscription brought about by a cause over which we have no control. But there are one or two interesting points that the alteration brings to mind. As already mentioned, the prepaid subscription of £1 1s. has been continued through the long period of 42 years—in fact, ever since the "JOURNAL" was first issued weekly at the price of 6d. per copy. Prior to that (from 1849), the prices varied per copy from 1s. to 1s. 6d. for first quarterly and then monthly issues, and later fortnightly numbers. In the sixties, 8d. per copy was the charge, with variations upwards for special numbers or issues containing supplements. When 6d. per copy and £1 1s. as the prepaid subscription were first charged, the size of a weekly issue ranged between 32 and 40 pages, and this without a wrapper, and, after the manner of the times, unstitched and uncut. But for years before the war, the size of our normal weekly issues had grown to from 64 to 72 pages, which growth was entirely due to the greatly extended interests of the gas industry, and the more complete record maintained of its affairs—technically, commercially, and geographically. With all this enlargement of information and therefore of value, combined with the additional expense of production, the price of the "JOURNAL" was continued at 6d., and the prepaid subscription at £1 1s.—the subscription, including postage, only representing 4·8d. per copy, as against the 6d. charged for single copies. With the new rate of prepaid subscription—£1 3s. 6d. per annum—the subscriber will obtain his copy weekly (including the higher postage) for less than 5½d.; so that the subscription rate will still be below the charge for a single copy, which is an unusual condition with technical and trade papers.

that the cost of redecorating, "&c.," in the artizans' dwellings administered by them was absorbing more than one-third of the rent, and even this amount was inadequate to keep pace with the deterioration which was largely due to gas, and it was found impossible to keep the houses clean. Now is not all this, as stated, pure exaggeration? If houses are fitted with incandescent gas-burners, there is no reason why there should be the need for redecoration any sooner than the conditions necessitate for health reasons. Anyone who has had any connection with the upkeep of cottage property knows full well that neither the 20 per cent., nor the £2000, nor the one-third of the rent of the artizans' dwellings, represents expenditure due to gas lighting. The "decoration" of houses occupied by the artizan classes is always liable to depreciate at a quicker rate than that of houses tenanted by persons of different occupations and different habits; and health demands that the insides of such houses shall receive somewhat frequent attention. The cost, too, of painting and keeping in repair the exterior of such dwellings is not light, but it is very necessary work. It is folly therefore to pretend that gas is primarily responsible for the cost of the upkeep of houses and maintaining them in sanitary condition. The writer has rooms in which bijou and medium-sized incandescent gas-lights are used, and which run for years without being redecorated; and so he knows, from personal experience, that Mr. Cleary's assertions do not in the amount of insinuation contained in them faithfully represent the truth of the matter, according to the experiences of other people. If Mr. Cleary was referring to the misuse of flat-flame burners (which are often employed in a way which renders combustion incomplete), he should have said so.

Installation and a Question of Lamps.

The methods of installing electric light in these artizan dwellings and flats are not exactly the sort that the Electrical Engineer of Brighton or the Editor of the "Electrician" would have in their own houses, in considering safety, maintenance, and appearance. Lead-covered cables were adopted; and the houses were looped together—the work being carried out inside the houses. Similarly lead-covered wire was used for internal wiring; and thus the cost per point came out at the low price of about 10s. 6d., including "first quality" switches, holders, ceiling roses, and flexibles. The articles specifically mentioned as being "included" do not refer to the slot meters, the cost of which, the "Electrician" says, is about 35 to 40 per cent. of the total expense of a prepayment installation. It is stated that lights are fixed in every room and in the hall; there being six points in the flats and seven points in the houses. Free lamps are also supplied, and are replaced in respect of electrical failures, but not if mechanically broken. The lamps, it appears, are 40-watt ones; so that the tenants of the houses and flats have to be content with a comparatively small amount of light in their rooms. The occupants of artizans' houses will not want many of these lamps to meet with a premature end, seeing that they have not many two and eightpences to spare for lamp replacement. The article tells us that the lives of these lamps were taken at 1000 hours, and it was estimated that there would be only one lamp failure per house per annum, instead of which there were only seven failures the first complete year out of a total of 275 lamps, fixed in 44 houses. But the first year is no criterion as to what will happen in succeeding years; and there is no question, judging from experiences among ordinary electricity users, that the estimated average of one lamp per house per annum will be exceeded in artizans' houses. Mr. Cleary does not say whether there were any lamps that came to an untimely end through causes other than electrical failure, and for which the consumers had to pay. In connection with this point of lamp failure at 2s. 8d. a time, Mr. Cleary makes the silly statement that "if full advantage is taken of this, it will enable us to lead where our rivals dare not follow, as a gas mantle in a gust of wind is like a puff ball reduced to powder." As a rule, there are not "gusts of wind" in dwelling-houses; and, in the writer's own house, he has inverted mantles that have been in service upwards of three years, and they have not been reduced to powder yet, but are yielding exceedingly good service.

Costs, Income, and Profits.

The price charged to the occupants of the dwellings and flats is 6d. a unit, which includes free lamps, slot meters, and free installation; and the average income per house is about 6d. per week, which means that some of the houses use less than a unit, others more. We should like to see a proper balance-sheet drawn up, giving all details of expenditure (including capital charges, maintenance, collection, &c.), together with the income, so that one might be able to judge better than is possible from the meagre information given in Mr. Cleary's article as to how far this cheap installation, low-consumption business is profitable to the Corporation. The "Electrician" says "the result is found financially satisfactory;" and Mr. Cleary says that this class of work "*given favourable conditions*," can be made remunerative. "Given favourable conditions" is an excellent safeguard. The income averages 26s. a year. The fitting-up of a house having seven points, at 10s. 6d., costs £3 13s. 6d. With a slot meter and other expenses, there must be more than £3 13s. 6d. to reckon as capital, the charges upon which have to be defrayed out of the 26s. income. On the £3 13s. 6d. alone, 10 per cent. for interest and depreciation amounts to 7s. 4d. It is not unusual in a house of seven or eight rooms to have to replace (say) three metallic filament lamps after a year's use. At 2s. 8d. each, this amounts to 8s. Maintenance also costs something. If 15s. 4d. represented the total outgoings from the 26s. income, we get 10s. 8d. as the balance for the 52 units, which means 2·46d. per unit. According to Garcke, the ordinary (flat-rate) consumers at Brighton are charged 4½d. and 3½d. per unit—they may be paying more during war time—so that the small consumers in the artizan dwellings appear to be supplied on preferential terms. Supposing 52 units were supplied at 4½d., this would amount to 19s. 6d.; leaving only 6s. 6d. to cover capital, depreciation, maintenance, and all other charges incidental to these installations. We fail to see, on the superficial evidence vouchsafed, how these installations can be called "financially satisfactory" or "remunerative;" and these are good class artizan houses, and not houses such as are occupied by the poorer sections of wage earners. There is another aspect of the matter. Mr. Cleary intimates that both classes of slot-consumer find electricity much cheaper than gas. He also says that there is no doubt that electricity at 6d. per unit can, providing that an installation scheme is introduced, displace gas at 2s. 10d. *plus* rentals, or 3s. 8d. per 1000 cubic feet, with free fittings. Now Mr. Cleary cannot dispute that a unit of electricity will only give a consumer 800 candle-hours, even allowing the best attainable efficiency with ordinary metallic filament lamps of 1 candle per 1·25 watts. With 6d., and gas (including fittings) at 3s. 8d., 136 cubic feet can be purchased; and with inverted burners (the mantles of which last almost an indefinite time), an efficiency of 20 candles per cubic foot is realized. So that the 6d. can purchase 2720 candle-hours, as against a maximum of 800 candle-hours under the scheme described by Mr. Cleary.

Larger Houses, Vision, and Infant Mortality.

Now if 6d. a unit pays with these artizan dwellings and their limited consumption including installation, lamps, maintenance, and all else, a similar scheme ought to pay better still in larger houses. Why not? Of course, we shall be told that an installation and equipment such as is found sufficiently satisfactory for these artizan dwellings and flats would not suit a larger house—in fact, would not be tolerated. The "Electrician" says: "It is essential that the first cost should be kept as low as possible, not merely in the house wiring, but in the services." Besides this, there is another defect in the equipment in these dwellings. The metallic filaments are exposed to the eyes of the occupants; and Mr. W. R. Cooper, speaking at the meeting of the Illuminating Engineering Society the other week, said: "To expose metallic filament lamps directly to the eye was wrong. He sometimes saw them used with clear glass globes, and by people who ought to know better." The Editor of the "Electrician" should impress this upon Mr. Christie in connection with the lighting of the artizan dwellings. The tenants ought to have a nice prismatic dish or globe for each lamp, or direct or semi-indirect lighting should be arranged for. If it is wrong to expose metallic filaments to the eyes of the rich, it is surely wrong to expose them to the eyes of the poor; if it is wrong to expose the filaments to the eyes of the workers in factories, it is wrong to expose the filaments to the eyes of those workers when at home. To wind up, we may as well give Mr. Cleary's final kick at gas: "The only opposition to the introduction of electric light for general use as an illuminant comes from those interested in the sale of gas and gas devices. This must be met and beaten in the interests of the community, as by the introduction of electric light a housing reform will be accomplished which will automatically overcome the great waste r ow caused by lamps and naked lights, and infant mortality will be reduced, thereby preventing the wastage of human life which the nation can ill afford." From this, it is supposed, we are to understand that among the other evils of gas "infant mortality" and "wastage of human life" must be reckoned. If so, and if Mr. Cleary will look round and note the multitudes of people reared in the world under gaslight and on gas-cooked food, he will see that his words contain something that can be added to the immense accumulation of foolish talk about gas that has emanated from the mouths and pens of electricians.

Electrically Heated Pants.

This is not a joke. It is a real and serious proposition. The German and Austrian armies do not relish winter campaigning and the physical inconvenience to which soldiers of the Central Powers are exposed through cold has, with the view of producing amelioration, been under the consideration of the ingenious Professor Max Beck, of Innsbruck, and Dr. von Schrötter, a Professor of Medicine at Vienna. They have solved the problem, and quite simply, by designing electrically heated pants, the wearers of which would be connected-up in series to the circuit when engaged in trench work. We are indebted to an article in the "Electrical Times" for the information. Wire woven into an asbestos fabric has long been employed for such novelties as electrically warmed carpets, mats, &c., and now the idea has been adapted to the pants heating scheme. For these, strong, supple wires are woven into texture chosen for its insulation properties. It is stated that the wearer of the electrically heated pants can readily connect-up to, or disconnect himself from, the circuit, which is supplied with energy through cables at a distance of 100 yards or so. The cost for current is given as ½d. to 1d. per hour per man; and, as there are twenty-four hours' heating to be done in a day, numerous cold days in

winter, and millions of men in the field, the pant-warming scheme would add considerably to the running expenses of the war. The electrically heated articles only weigh 30 oz.; and the initial cost per man is stated to be £3 6s. 8d. to £4 3s. 4d. Then there is the maintenance of the electrical warming "installation." So that, all told, this is an expensive proposition. If the ½d. or 1d. per hour for current represents the cost of a unit of electricity, our contemporary thinks that the supply of 1000 watts to the pants of an enemy soldier for any length of time would be as effective from the Allies' point of view, as a bullet. Besides, the men's lower extremities immersed in mud and water would not conduce to comfortable electrical treatment; and the pants we imagine would be found rather inconvenient with *entente cordiale* bayonets in close proximity. We reckon they would rather impede motion; and the entanglement of connecting-wires at the rear would not facilitate matters, in the disorder that follows the appearance of bayonets or other causes for expediting movement.

COKE AND OTHER MATTERS.

By "Qui Vive."

Sale of Coke in Small Quantities.

How many gas undertakings give poor people the opportunity of buying coke in small quantities at a reasonable price? Some do, it is true; but a great many leave the poor to the mercy of the hawker, who often makes a fabulous percentage profit in selling coke by the "penn'orth." From his point of view it may be fair, for he has a living to make, though in doing so he exacts a huge price per hundredweight or per ton for all his customers buy from him. This is not in the interests of the poor, nor is it to the interest of the market for coke, which is thereby rendered much more expensive than need be the case.

It is not suggested that gas undertakings should engage in the hawking of coke, for it is an unprofitable business; but it is suggested that all possible facilities should be given poor people to come to the works and carry away ¼ cwt. of coke in a sack, barrow, or other receptacle at the actual yard price. This is altogether a better proposition then to sell them ¼ cwt. of coke in an expensive paper bag, costing about ½d., for which they have the pleasure of paying. Further the paper bag has to be filled; while the filling might just as well be done into the receptacle brought for the purpose. The best method is to use a weighing machine fitted with a scoop which will comfortably hold ¼ cwt. of coke, and which is well-designed for filling anything from a sack to a barrow. An old man or boy is quite suitable for such work; and, being a single-handed job, there is an advantage in cost as compared with using paper bags, which can only be filled with the aid of a second person. From every point of view it is preferable, in the writer's opinion, to dispense if possible with the paper bags, which are flimsy and very liable to break, and are soon rendered altogether useless if the coke is wet or if brought into contact with dampness.

To popularize a system of selling coke loose and in small quantities, it might prove feasible to sell ¼ cwt. tickets to shopkeepers in dozen, or even larger, lots, at a discount of (say) 3d. per dozen tickets. In this way much could doubtless be done, and in a manner which should prove a boon to those who could not otherwise afford to buy fuel in the middle of the week. At the present time, when delivering facilities are so much restricted, every possible step has to be taken to induce the actual users of the fuel to remove the coke; and any scheme which has this for its object is at least deserving of consideration. Perhaps readers will be good enough to describe in the columns of the "Journal" any system which they may have adopted with a view to inducing all classes of customers to fetch their coke.

Inducements to Dealers.

Then, n the case of the more well-to-do people, who generally purchase their fuel through the local coal merchant, much may be done by engaging the sympathy of this gentleman in the only possible way that will interest him, and that is by making it more attractive for him to sell coke than coal. When this essential factor has had due attention, the economy, efficiency, and advantages of coke will be put before the public in their proper light. During such times as the present, it cannot be a good policy to attempt to cut down the man with the horses, vans, and what is more important, the labour to work them, to the minimum tonnage rate; for, on the one hand, expenses are exceedingly heavy, while, on the other hand, coke is fetching high prices. The best policy is undoubtedly to offer liberal rates, and in this way secure the vans for the cartage of coke in preference to coal.

It must, of course, not be forgotten that rates of discount, when expressed in percentage figures, operate very greatly to the advantage of the dealer when prices are high, for a 10 per cent. discount on coke when it is priced at 25s. per ton is 2s. 6d. as compared with 1s. 6d. when the price is 15s., though the tonnage to be handled is virtually the same. On the other hand, discounts, when expressed in a definite rebate per ton, give the dealer the same terms whether the price be high or low. It is a moot point as to which is the better system, and arguments can be advanced in favour of both methods, varying with the circumstances existing at the time.

NAPHTHALENE AND GAS WASHING.

By Thomas Glover, of Norwich.

In the "Journal" for Oct. 26, allusion was made to this subject in the first editorial article; and a little discussion of the point is appropriate, and may be useful, under present circumstances.

The question as to whether the naphthalene content of gas is increased or decreased by working the "C" process, depends principally upon three factors.

(1) The naphthalene content of the tar used as the washing medium.

(2) The proportion of light hydrocarbon vapours to the vapour of naphthalene present in the gaseous products of carbonization.

(3) The temperature conditions under which the washing process is conducted.

With regard to the first factor, the naphthalene content of the tar will depend primarily upon the conditions under which the coal is carbonized; small charges and high heats, with exposure of the gaseous products to prolonged cracking conditions, being conducive to the production of naphthalene and other products of decomposition. In working small horizontal charges for six-hour periods, the gaseous products of the distillation as they pass along under the soffit of the retort are exposed to radiant heat and contact with highly-heated surface. The velocity of these gaseous products through the retort is such that the time-contact with the highly-heated surface, and the effect of radiant heat, are sufficient to bring about very considerable decomposition, resulting in the formation of naphthalene among other products of such decomposition. The condensable vapours forming the tars, and permanent vapours contained in the gas, will consist partly of products due to incomplete decomposition formed in the early stages of carbonization, and partly of products resulting from secondary reactions taking place between the products of decomposition formed during the later period of the distillation, due to the gaseous products being exposed by contact to the highly-heated coked mass and retort surface, and for too long a period. These latter products will predominate; and the tar and gas will contain a large quantity of naphthalene, up to the point of saturation at low temperatures.

As to the second factor, the light hydrocarbon vapours produced in the process of distillation will consist partly of hydrocarbons the formation of which is due to incomplete decomposition, and of products due to secondary reactions brought about by exposure to radiant heat and contact with hot surfaces, as in the case of the tar. Paraffins may be cited as an example of the first order, and naphthalene as an example of the second. The relative proportions in which these hydrocarbons are produced will depend upon the conditions under which the coal is carbonized. Some of these hydrocarbon vapours condense, and become liquid at atmospheric temperatures, and others remain in a condition of vapour in the gas. The former come down in the condensers, where, if the gas is supersaturated with naphthalene vapour, a portion of naphthalene is also deposited, and carried away in solution by such condensates. Those vapours which do not condense go forward with the gas, together with such naphthalene vapour as has escaped absorption and deposition in the condensers.

Upon these gases and vapours entering the tar-washing apparatus, and coming into intimate contact with the tar, the bulk of them will be absorbed. The quantity of naphthalene absorbed by the tar will depend upon the capacity of the tar to absorb naphthalene. If the tar be already supersaturated, naphthalene will leave the tar for the gas; whereas if the solvents in the tar are not fully saturated, the naphthalene will be removed from the gas.

With regard to the third factor, the vapour tension of the naphthalene contained in the tar varies with the temperature of the tar, or, in other words, the capacity of the tar to absorb naphthalene and naphthas increases as the temperature falls, and decreases as the temperature rises.

The introduction of heavy charges working twelve-hour periods —the retort being completely filled—has been found to avoid all trouble with naphthalene. The "free space" above the charge is reduced almost to extinction; and, owing to the increased gas production per unit volume of retort space, the velocity of the gaseous products through the retort reduces to a minimum the time contact of such products to the heated surfaces. The early stage of carbonization under these conditions takes place at a comparatively low temperature, resulting in products of incomplete decomposition. Hydrocarbons of the paraffin series are produced, both gaseous and liquid, together with toluene, xylene, &c. Towards the end of the distillation—a high temperature being reached—benzene, naphthalene, and similar high-temperature products are formed; but, as a proportion of the total products of the distillation, they are in far less quantity than is the case with small charges of short duration.

Tar from small eight-hour charges yields upon distillation 4 per cent. by volume of light oils; the naphthalene content of the products of distillation being at a maximum as before-mentioned. The tar from heavy twelve-hour charges yields 22½ per cent. of such light oils; the naphthalene content of the distillation pro-

ducts being at a minimum. This well illustrates the reason of the absence of trouble experienced with twelve-hour work.

In cases where machinery for more or less completely filling the retorts does not exist, some advantage should be found by adopting as heavy a charge as can be put in. It is, of course, important that such a charge should be evenly laid.

Where small charges have to be worked in conjunction with the "C" process, there must necessarily be a shortage of solvents left in the gas after the washing process, and in many cases the naphthalene content of both gas and tars will be relatively high. The gas at the outlet of the washing apparatus, under some conditions of temperature in certain cases, will contain more naphthalene than at the inlet of such apparatus.

In these instances, some method should be adopted of adding to the gas what it lacks in the way of naphtha vapours of approximately the same vapour tension as naphthalene. The point at which the addition should be made must depend upon circumstances. If the naphthalene deposit takes place in the works plant, the vapour should be added at the outlet of the "C" process apparatus; but if peculiar to the distributing plant, at the inlet or outlet of the station meters.

Washing the gas with water-gas tar—provided such tar contains a large proportion of low boiling fractions—after the "C" process apparatus, would be a good method of further reducing the naphthalene content of the gas, and at the same time compensating for the previous extraction of naphtha vapours which should accompany the remaining naphthalene, and prevent its subsequent deposition in the solid form.

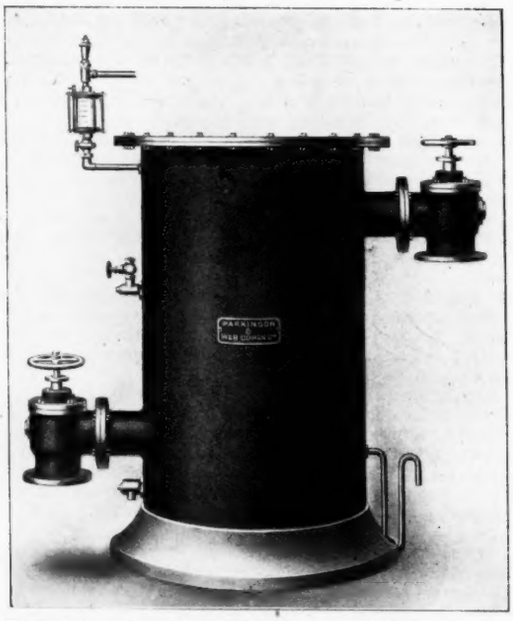
If circumstances prevent this system being adopted, the most direct way to prevent deposits is to vaporize into the gas ordinary petroleum at the rate of 20 gallons per million feet. Relief will follow almost immediately; and future trouble will be avoided by consistently following this practice, adjusting the quantity of oil vaporized to match the condition and quality of the gas from time to time.

It may be well to remember that the naphthas in water-gas tar contain a quantity of low-boiling paraffin bodies as well as those belonging to the aromatic series of hydrocarbons. These naphthas in the form of vapour are quite suitable for accompanying naphthalene vapour in the gas, and, if present in sufficient quantity, will prevent its deposition as a solid, but are unsuitable as a source of pure benzol and toluol.

PETROLEUM VAPORIZER FOR PREVENTING NAPHTHALENE DEPOSITS.

A Simple Apparatus and a Reliable Remedy.

THE old trouble of naphthalene deposits in mains and services is again upon gas engineers in many places; and one has not to seek far for the cause. The trouble had been lightened considerably since heavier retort charging and longer duration carbonization became the practice, through which practice the quantity of condensable solvents for naphthalene in the gas was augmented, and the naphthalene content of the gas was correspondingly reduced. But the revival of the naphthalene difficulty in a form both disagreeable and irksome is due to meeting the requirements of the Ministry of Munitions regarding the extraction of benzol, toluol, &c. Although the almost generally used process by which this removal is effected reduces the number of grains of naphthalene per 100 cubic feet, it also largely depletes the gas of its naphtha vapours, and to such an extent that insufficient is left to accompany the naphthalene to the point at which, together, they condense out of the gas, and solid deposition results. The quickest and most obvious remedy for this is to restore to the gas an equivalent of that of which it is deficient for obviating the trouble. The addition to the gas of quite a small quantity of vaporized petroleum—ordinary burning oil, about ·780 to ·820 specific gravity, which readily vaporizers at the temperature of high-pressure steam, say from 300° to 320° Fahr.—will effectually prevent the deposition of solid naphthalene, and dissolve out any naphthalene crystals already deposited.



The Petroleum Vaporizer for Preventing Naphthalene Deposits.

Messrs. Parkinson and W. & B. Cowan, Limited, of Cottage Lane Works, City Road, E.C., opportunely call attention to a simple form of apparatus designed by Mr. Thomas Glover, M.Inst.C.E., of Norwich, for treating gas with petroleum vapour, either at the outlet of the purifiers or at the inlet of the holders. The carburettor comprises a cast-iron tank, inside which is fitted a suitable high-pressure steam-heated vaporizing arrangement. On to the heating surface of the vaporizer, the oil drops from a distributor; and the resulting vapour is carried off by the stream of gas passing through the apparatus. In regard to the structural details, the tank of No. 1 carburettor is 3 feet in diameter by 5 feet deep, inside measurements. The cover is fastened on with ½-inch bolts and nuts spaced 6 inches apart; the edges of the flanges being finished bright. The steam-coil inside the tank is made of a single length of 1½-inch internal diameter tube, about 90 feet long. It is connected to a 1-inch steam-supply pipe, controlled by a gun-metal valve; the outlet of the coil being carried to a ¾-inch steam-trap. With this steam-trap, while the quantity of steam used is but trifling, the high temperature of the vaporizing surface is ensured, as full boiler pressure can be used. The distributor is made of strong tinned iron, and is fitted above the steam-coil. The oil supply drops from a tundish, from which it flows to the distributor. The oil-supply pipe leading from the oil-tank to the apparatus passes through a sight-feed regulator and adjustment valve, fitted with a glass cylinder and shut-off cock. With the sight-feed, the approximate quantity of oil passing per hour can be seen by a minute's observation; and the valve permits of very fine adjustments being made to the flow of the oil according to the volume of gas passing. The inlet and outlet connections to the apparatus are 6 inches diameter, and each is fitted with a 6-inch screw-down disc valve with wheels, spindles, glands, &c. A syphon overflow is provided for condensed oil.

Among other considerations attaching to the use of these carburettors (a number of which have been successfully in service for several years) are these:

(1) It is easy to ensure a sufficient stream of gas passing through the carburettor to carry the vapour, by causing a slight back-pressure in the main, and so ensuring a difference of a few tenths between the inlet and outlet of the carburettor.

(2) When petroleum vapour is added to the gas in the way described, there is usually a slight permanent enrichment up to a maximum of 1 candle; and although this is not the main purpose of the apparatus, it is an incidental result which can only be considered a decided advantage.

(3) In addition to its primary purpose, the carburettor can be used for rapidly improving the value of the gas, when for some accidental reason this has temporarily become unduly low. When enrichment only is required, petrol or benzol is delivered into the carburettor, instead of petroleum.

(4) Petroleum and petroleum vapour are both extremely penetrating and destructive of ordinary joints. The carburettor has been designed with special reference to this difficulty; the joints being few in number, and these made in such a manner as to resist the solvent action of the oil.

Concerning the quantity of petroleum required, this will necessarily vary to some extent with local circumstances; but, under average conditions, it has been found that 25 gallons of petroleum will deal satisfactorily with about 1 million cubic feet of gas. Half this quantity may be used after the first month or so. In selecting a carburettor of suitable size, it is essential to bear in mind that it is sometimes necessary to vaporize the oil at a much greater rate in proportion to the quantity of gas sent out, as, if there is an accumulation of naphthalene deposits on the district, the addition of a considerable quantity of petroleum vapour is the cheapest and most efficient method of disposing of them. The sending out of the vapour in quantity would, of course, only be necessary when naphthalene deposits had accumulated, and then only for a short period.

A CRITICAL REVIEW OF THE METHOD EMPLOYED FOR DETERMINING HEATS OF COMBUSTION.

By Stanley Robson, M.Sc. (1851 Exhibition Scholar of the Armstrong College, Newcastle-on-Tyne), Research Student in the Department of Chemical Technology, the Imperial College of Science and Technology, London.

(*Continued from page* 534.)

Work of Marcellin Berthelot on the Determination of Heats of Combustion.

Berthelot's work in this connection must be dealt with in some detail, for not only is his experimental method essentially different from that of Thomsen, but also his experimental results in some cases differ seriously from those of this contemporary worker. Berthelot's work may be conveniently divided into two periods. The first period embraces his work with combustion chambers similar to those of Favre and Silbermann. The second period embraces his work with the bomb calorimeter, and includes the redetermination of most of the values obtained during the former period. One matter to be regretted in connection with the published accounts of Berthelot's work is that detailed information concerning the preparation and purification of the substances examined is not always given. This is especially true in the case of gases.

Berthelot's Earlier Experiments.

Berthelot used an apparatus similar to that of Favre and Silbermann for his earlier investigations. The combustion chamber need only be described. This differed from others of its type in being constructed of glass. The oxygen was supplied through the tube *t* (Fig. VII.) and the products of combustion escaped through the glass spiral *s*. The solid or liquid to be burnt was placed in a porcelain crucible *r*, supported from the large rubber stopper B, which was protected from the flame during combustion by two mica plates *m m*. Piercing the stopper B was a tube T, through which a burning fragment of carbon was dropped in order to ignite the substance in the crucible *r*.

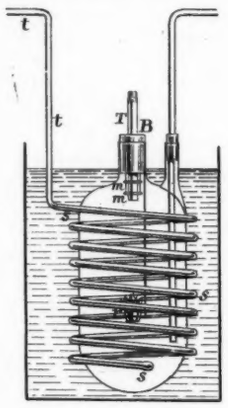


Fig. VII.—Berthelot's Combustion Chamber for Solids and Liquids.

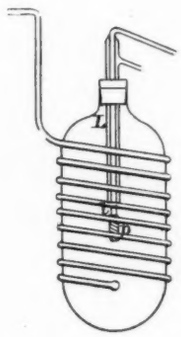


Fig. VIII.—Berthelot's Combustion Chamber for Liquids.

The modification of this apparatus for the combustion of gases is shown in Fig. VIII. The combustible gas was led into the chamber by the inner tube *l*, and was burnt on the surface of the platinum gauze *p* in a current of oxygen which was supplied through L. By means of the above method Berthelot obtained what he afterwards considered to be satisfactory results in the case of hydrogen, carbon monoxide, and sulphur.*

Berthelot's Investigations with the Bomb Calorimeter.

In a paper entitled "New Researches on the Measurement of the Heat of Formation of Organic Compounds," published in the "Annales de Chemie et de Physique," Fifth Series, Vol. XXIII., 1881, Berthelot expressed his dissatisfaction with the calorimetric methods used up to that time. His main objections were:

(1) The long duration of the combustion (10 to 15 minutes) which necessitated a large correction for the loss and gain of heat from the surrounding atmosphere.
(2) The incomplete character of the combustion.

He therefore proposed a method for the measurement of the heat of combustion of gases by detonation.

The apparatus employed in this research is shown in Fig. IX. The bomb was lined with platinum or gold, and the combustible gas, with the exact amount of oxygen required for its combustion or with an excess where permissible, was forced in or out as required, by means of a mercury pump and an apparatus analogous to Regnault's eudiometer, but of ½ litre capacity. The insulating material was of ivory, protected by mica. The capacity of the bomb was one litre. Owing, however, to the limited amount of material which could be placed in this volume with comparatively low pressures, the temperature elevation (read to $\frac{1}{100}$° C.) was only from 1·5° to 2° C., and the weight of carbon dioxide formed did not in general exceed 0·200 to 0·300 gram.

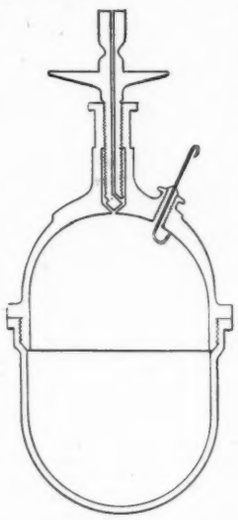


Fig. IX.—Berthelot's Original Bomb.

The quantity of gas burnt was measured, in the case of hydrogen, by its initial volume. The less difficult method of weighing the products of combustion was, however, generally adopted. Samples of the gas under examination were always, previous to an experiment, exploded in a eudiometer to see if it were pure, and likewise the final products were always examined for unburnt gases. Volatile liquids were weighed in glass globes and broken in the bomb. The values thus obtained were measures of the heat of combustion at constant volume; while combustion in open vessels gives values at constant pressure. To connect these quantities, Berthelot deduced the following equation:

$$Q T_p = Q T_v + 0{\cdot}5424\,(n - n^1) + 0{\cdot}002\,(n - n^1)\,T.$$

Where $Q T_p$ is the quantity of heat at constant pressure at the temperature T,
$Q T_v$ is the quantity of heat at constant volume at the temperature T,
n is the number of units of molecular volume occupied by the components,
n^1 is the number of units of molecular volume occupied by the products,
T is the temperature in centigrade degrees from the ordinary zero.

Berthelot's Method of Temperature Correction for Loss and Gain of Heat to His Bomb Calorimeter.

When dealing with heats of combustion by his bomb method, Berthelot's method of correction of the recorded temperature of the water of the calorimeter was similar to that of Favre and Silbermann. As he never allowed more than two to three degrees difference between the calorimeter and its surroundings, nor the temperature of the surrounding air to be more than 20° C., and more particularly since the maximum temperature was always reached in two to three minutes, this method was almost perfectly accurate. In such cases a consideration of the minute and half-minute readings made during the experiment gave sufficient data for the small correction which was necessary. To illustrate both his experimental method and his method of temperature correction, the following example of a determination of the heat of combustion of ethane (C_2H_6) is given.

Course of an Experiment.*

There was mixed 200 c.c. of ethane with 720 c.c. of oxygen over mercury and admitted to the previously exhausted bomb. The bomb was then allowed to stand in the calorimeter till the temperature rose or fell constantly. The experiment was then begun; the temperature being read every minute and the mixture fired at the sixth minute. The following temperatures were recorded:

Period Previous to Ignition.		Period of Combustion.		Period of Recooling.	
Time in Minutes.	Temperature.	Minutes.	Temperature.	Minutes.	Temperature.
0	13·295° C.	5	13 295	7	14·745
1	13·295° C.	6	14·740	8	14·735
2	13·295° C.	7	14 745	9	14·725
3	13·295° C.	..	..	10	14·715
4	13·295° C.	..	..	11	14·705
5	13 295° C.	..	..	12	14·695

* This is the only experiment described in detail by Berthelot.

* "Traité Pratique de Calorimétrie Chimique," p. 216.

Carbon Monoxide.		Sulphur.
(1) 68·50	..	34·57
(2) 68·22	..	34 54
(3) 68·12	..	34·39
—	..	34·70

This being finished, the carbon dioxide was extracted from the bomb by means of the mercury pump, and carried slowly through a bulb of concentrated sulphuric acid—a U-tube of pumice moistened with sulphuric acid—and then through a Liebig tube of potash solution and a small U-tube of solid caustic potash. The bomb was then washed out three times with carbon dioxide free air, to extract the last traces of carbon dioxide formed during the combustion. The total weight of carbon dioxide thus formed was in this experiment 0·2090 gram.

The total heat produced was given by the product of the water and the water equivalent of the apparatus and the temperature variation.

$$\xi\,\mu \times \Delta t = (\mu_w + \mu_e) \times [(t_2 - t_1) + \rho]$$

where μ_w = the weight of the water in the calorimeter,
μ_e = the water equivalent of the apparatus,
t_1 = the temperature previous to ignition,
t_2 = the maximum recorded temperature,
ρ = the correction for loss and gain of heat from the surroundings.

Berthelot fixed his value for ρ in this case thus: "In the initial period of five minutes previous to the detonation, there was neither gain nor loss. The maximum was established a minute and a half after detonation. In the five minutes which followed (final period), the loss was regular, and equal to 0·01° per minute. From this the loss between the fifth and sixth minutes can be valued at a half—*i.e.*, 0·005°—and between the seventh and eight it is 0·01. The total correction ρ would therefore be 0·015°, which makes $\Delta t = 1{\cdot}465°$."

$$\therefore\ \xi\,\mu + \Delta t = (627{\cdot}4) \times [(14{\cdot}745 - 13{\cdot}295) + 0{\cdot}015]$$
$$= 627{\cdot}4 \times 1{\cdot}465$$
$$= 919{\cdot}14 \text{ calories.}$$

A certain amount of water vapour remained in the bomb, corresponding to the vapour tension of water at 14·74°. Using Regnault's figures, this correction amounted to 1·85 calories; making the true total heat equal to 919·14 + 1·85 calories = 920·99 calories. This was the heat of combustion of this quantity of dimethylene which produced 0·2090 gram of carbon dioxide. The heat of combustion of one gram molecule of ethane therefore was

387·78 Calories at C*v*
389·21 Calories at C*p*

In the above manner, Berthelot obtained the following results:

Carbon Monoxide.	Hydrogen.	Methane.	Ethane.	Ethylene.	Acetylene.
68·0 C*v*	69·2 C*v*	213·2	384·6	341·0	318·7
68·3 C*p*		214·3	388·7	341·4	311·0
		210·7	389·7	337·0	
				341·9	314·9 C*v*
		212·4 C*v*	387·4 C*v*	340·3 C*v*	315·7 C*p*
		213·5 C*p*	388·8 C*p*	341·4 C*p*	

It will be seen from the foregoing that Berthelot's original method for the combustion of gases by detonation was exactly similar in principle to that of Andrews. He appears to have been quite ignorant of Andrews' apparatus, though he was evidently in possession of his results—in fact, he was so far mistaken as to attribute to this worker the general methods used by Thomsen and Favre and Silbermann.* In view of the close association of Berthelot's name with the "Bomb Calorimeter," it is perhaps well to point out that Thomas Andrews originally conceived the method.

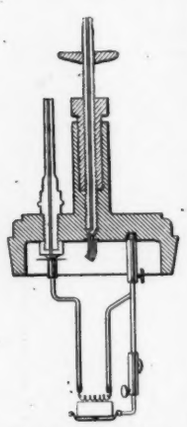


Fig. X.—Berthelot's Arrangement for the Combustion of Solids in his Bomb Calorimeter.

With the introduction of compressed cylinders of oxygen, Berthelot found it possible to make more accurate determinations of the heat of combustion of gases in the following manner. The volume of the bomb was accurately measured, and the combustible gas was forced into it at a small pressure. Sufficient gas was then allowed to escape to reduce the pressure in the bomb to that of the atmosphere. The amount of oxygen required was then forced into the bomb from the cylinder. The weight of the combustible gas was then known, both from its volume and from the weight of its products of combustion, which thus provided a check upon the experiments. The principal advantage, however, lay in the fact that a greater weight of material was used than in the previous experiments.

In this way the following values were obtained.†

BERTHELOT.—*Heat of Combustion of Some Gases in Calories per Gram Mol. or Gram Atom.*

Substance.	Method of Preparation and Purification.	Values.
Hydrogen	No account given	68·9 66·8 67·9 68·2 67·95 C*v* 68·95 C*p*
Carbon monoxide	No account given; but it appears probable that it was obtained from oxalic acid. Berthelot affirms its purity in answer to a communication from Thomsen.	68·6 67·9 67·5 67·3 C*v* 68·2 C*p*
Ethane	Obtained by the electrolysis of sodium acetate, according to the method of Kolbe ["Ann. Chim. Phys." [5] XXIII., p. 179]. The gas was purified from ethylene by bromine, and from carbon monoxide by absorption over acid cuprous chloride.	371·5 370·6 370·5 370·9 C*v* 372·3 C*p*
Ethylene	Prepared from alcohol and sulphuric acid. The gas was quite absorbed (to 1 : 100) by bromine water or by concentrated sulphuric acid.	341·5 339·7 339·4 340·2 C*v* 341·3 C*p*
Acetylene	Prepared from copper acetylide.	318·7 311·0 314·9 C*v* 315·7 C*p*

A further advantage of the bomb calorimeter, however, was found to lie in its applicability to the determination of the heat of combustion of solids. No other form of combustion vessel will, in the case of the less-easily combustible solids such as carbon, allow the substance to be completely burnt. Thomsen did not carry out experiments with solids—thus avoiding the difficulty; while Favre and Silbermann and other workers corrected for incomplete combustion after a consideration of an analysis of the products, as previously described. The use of the bomb calorimeter, on the other hand, ensured complete combustion, and, moreover, avoided any external method of ignition.

Berthelot's modification of his original calorimeter for the determination of the heats of combustion of solids is shown in Fig. X.; but it is now so well known that it need not be described here.

Values of Berthelot and Petit for Carbon, in calories per gram.

Charcoal.	Graphite.	Diamond.
8136·6	7910 4	7853·6
8139·4	7896·5	7861·4
8140·6	7900·6	7862·2
8134·3	7900·6	7858·8
8141·8	7900·9	
8137·4	7901·2	7859·9

The charcoal was purified by successive treatment with boiling hydrochloric acid, hydrofluoric acid, and chlorine. It was then calcined and cooled *in vacuo*, in order to remove hydrogen and moisture, and burnt in the bomb in oxygen under a pressure of 25 atmospheres.

The graphite (furnace) was purified by repeated extraction with hydrochloric acid. In order to aid the combustion, it was necessary to add naphthalene, whose heat of combustion, determined in four series of experiments by three groups of operators with three different pieces of apparatus, was regarded as known with great accuracy, and taken as 9692 calories per gram at constant volume. From one-third to a fifth of naphthalene by weight was added to the graphite and carefully melted in, so as to form a coating. To avoid occluded hydrogen, the graphite was always momentarily heated to redness. Even with the addition of naphthalene several milligrams of carbon sometimes escaped combustion, so that the platinum capsule which contained the carbon was weighed on the completion of the experiment. The diamond was broken to small pieces and extracted with hydrochloric acid.

STOHMANN'S WORK.

Using Berthelot's methods, Stohmann (a contemporary German worker) obtained highly accurate results for many of the more complex compounds. Of these only benzene and naphthalene are important in our connection.

Stohmann's Values for Benzene.

779·53 Calories per gram molecule = 9987·8 calories per gram. This is the mean result of earlier experiments with Kleber and Langbein.*
779·0 Calories per gram molecule = 9981·04 calories per gram.
777·5 " " " = 9961·81 " "
Results of experiments with Rodatz and Herzberg.†

* Ann. Chim. et Phys., Series 5, Vol. XXIII., p. 147.
† Ann. Chim. et Phys., Series 6, Vol. XXX., p. 350.

* J. Pr. Chem. [2], 30, pp. 241–260. † *Ibid.*, 40, pp. 77–95.

WHY FINANCE OUR ENEMIES?

In view of the nameless advertisements which have appeared in the various Trade Papers, we think it well to call our many friends' attention to the following facts :—

We can and do supply British-Made Mantles,

also mantles of guaranteed Dutch manufacture. A Dutch Factory was visited by our Principal to make quite sure that there would be no direct or indirect dealings with Germans or German goods. Furthermore, this Factory was visited by the representatives of our Board of Trade, who have satisfied themselves as regards their products. This we think is sufficient guarantee that the Dutch Mantles we sell are not in any way German.

Any friends of ours purchasing Incandescent Mantles from us of Dutch Manufacture can accept same with every confidence that no German material, labour, or capital is used in the manufacture of them.

THIS IS WHAT SOME OF OUR MANTLE COMPETITORS CANNOT SAY THEMSELVES.

Being a purely British Firm, we should naturally have preferred to have placed all our requirements in this country, but being very large wholesale suppliers we found, as a matter of price, this was impossible. We have to cater for the better British makes, as well as the cheaper Dutch brands. Also from last season's experience, we found that we could not depend upon supplies in this country.

THE OBJECT OF OUR COMPETITORS IS TOO OBVIOUS. They wish to create a doubt with regard to Dutch Incandescent Mantles so as to be able to force up their own prices.

In ordering British Mantles be sure you are placing your orders with a British House, not with a house owned, managed, or financed by Germans or Austrians (naturalized or otherwise).

The irony of the advertisements referred to is that one of the firms a party to the advertisements have themselves imported many hundreds of gross of Dutch, or, as their advertisements say, "so-called Dutch Mantles."

LET US KNOW YOUR REQUIREMENTS.

WE GUARANTEE SATISFACTION.

ESTD. 1839

and at Glasgow

J. & W. B. Smith

15, 17, 19, 21 & 25 FARRINGDON ROAD, LONDON.

THE GRATE-FIRE SERIES.

Suitable for every type of Coal Grate.

THE SUBSTITUTES FOR THE COAL FIRE in the EXISTING FIREPLACE.
EASILY FITTED. DO NOT FIRE BACK. LOW MAINTENANCE COST.

"GROSVENOR."

FITTED INTO ORDINARY COAL GRATES.

"JET."

PROGRESSIVE BUILDING.

UTILITY WITH ECONOMY.

Advise your ARCHITECTS, BUILDERS, and CONSUMERS to save the unnecessary expense of Installing Coal Grates, and to specify—

THE "MAYFAIR" COMPLETE GAS GRATE.

Bedroom Grate in a London Club.

Fitted throughout the Members' Bedrooms at an important London Club.

For full particulars apply for descriptive pamphlet.

FLETCHER, RUSSELL, & CO., LTD.,

WARRINGTON, MANCHESTER, and LONDON.

Stohmann's Values for Naphthalene.

Calories per Gram Molecule.		calories per gram.
1232·1	..	9625·7
1232·5	..	9629·0
1230·4	..	9612·3
1234·9	..	9647·4
1232·2	..	9611·3
1230·2	..	9629·4
1233·8	..	9638·9
1233·0	..	9628·3
1232·4 at Cv	..	9628·3 at Cv
1233·6 at Cp	..	9640·0 at Cp

Stohmann's method of temperature correction is an application of the Regnault-Phaundler system. A series of observations taken every minute was made as soon as the temperature of the bomb is that of the calorimeter . . . "t_1" "t_2" "t_3" . . . "t_{n1}." When these differences were practically constant, the combustion was begun.

The temperature readings during the progress of the combustion were also taken every minute $\theta_1\ \theta_2\ \theta_3\ .\ .\ .\ \theta_n$. These were usually only five in number, and the first value θ_1 was equal to t_{n1}. A similar set of readings for the cooling were also taken:

$$t_1^1\ t_2^1\ t_3^1\ .\ .\ .\ t_n^1 \qquad t_1^1 = \theta_n$$

The average temperature rise (v) and fall (v^1) was given by the equations $v = \frac{t_{n1} - t_1}{n_1 - 1}$ $v^1 = \frac{t_{n1}^1 - t_1^1}{n_1^1 - 1}$. The average temperature before the ignition (T) is given by the equation:

$$T = \frac{t_1 + t_2 + t_3\ .\ .\ .\ .\ t_n}{n_1}$$

and during the observed cooling by:

$$T^1 = \frac{t_1^1 + t_2^1 + t_3^1\ .\ .\ .\ .\ t_{n1}^1}{n_1^1}.$$

The Regnault-Phaundler rule for determining the loss during the period of combustion is given by the equation:

$$\Sigma\,\Delta\,t = \frac{v - v^1}{t^1 - 2}\left[\Sigma_1^{n-1}\theta + \frac{\theta_n + \theta_1}{2} - n\,T - (n-1)\,v\right].$$

The maximum temperature in this type of experiment is, however, almost reached after the first minute, so that $\theta_2 = \theta_3 = \theta_4 = \theta_n$ very nearly, and also $T = \theta_1$ and $T^1 = \theta_n$ approximately. There is not a uniform rise during the first minute, so that the true average temperature over this minute is somewhat higher than the arithmetic mean. Direct experiment showed that the correction to apply for this error is $\frac{\theta_2 - \theta_1}{9}$. The term $\Sigma_1^{n-1}\theta$ thus can be found by the equation:

$$\Sigma_1^{n-1}\theta = \theta_1 + \theta_2 + \theta_3\ .\ .\ .\ .\ + \theta_n + \frac{\theta_2 - \theta_1}{9}.$$

The following experimental details for the heat of combustion of anisic acid* will serve to illustrate the method of correction:

Weight of anisic acid burnt = 1·0770 grams.
Water equivalent of the apparatus = 2500 grams.
Temperature readings in m.m.

t_1 = 26 8	..	θ_1 = 28·9	..	t_1^1 = 214·0
t_2 = 27·2	..	θ_2 = 202·0	..	t_2^1 = 213·8
t_3 = 27·7	..	θ_3 = 213·0	..	t_3^1 = 213·6
28·1	..	θ_4 = 214 2	..	213·5
28·5	..	θ_n = 214·0	..	213·3
t_{n1} = 28·9	..		..	213·1
				212·9
				212·7
				212·6
				212·4
				t_{1n}^1 = 212·2

Therefore:

v = 0·42	..	T = 27·9	..	n = 5
v^1 = 0·18	..	T^1 = 213·1		

$$\Sigma\,\Delta\,t = \frac{v - v^1}{\theta_n - \theta_1}\left(\Sigma_1^{n-1}\theta + \frac{\theta_n + \theta_1}{2} - n\,T\right) - (n-1)\,v$$

$$\Sigma_1^{n-1} = \theta_1 + \theta_2 + \theta_3 + \theta_4 + \frac{\theta_2 - \theta_1}{9} = 677$$

$$\therefore\ \Sigma\,\Delta\,t = \frac{0{\cdot}42 - (-0{\cdot}18)}{213{\cdot}1 - 27{\cdot}9}\left(677 + \frac{214 + 29}{2} - 5 \times 27{\cdot}9\right) - 4 \times 0{\cdot}2 = +0{\cdot}45.$$

The corrected maximum temperature θ_n .	= 2140 + 0·45 m.m.
	= 15° 3699 C.
The initial temperature θ_1	28·9 m.m.
	= 12°·8406 C.
The rise in temperature therefore . . .	= 2·5293 C.
The amount of heat produced	= 2·5293 × 2500 cals.
	= 6323·3 cals.
Heat due to the wire ignition	= 17·3 ,,
Heat due to the formation of nitric acid .	= 8·2 ,,
Therefore 1·070 grams anisic acid yield .	6306·0 ,,
One gram anisic acid yields	5893·5 ,,
One gram molecule ,, ...	895 8 Cals.

(*To be concluded.*)

* This experiment is described in greater detail than those on benzene and naphthalene.

CARE AND MAINTENANCE OF "DE BROUWER" RETORT CHARGING AND DISCHARGING PLANT.

By H. C. Widlake, M.J.Inst.E., of the Plymouth and Stonehouse Gaslight and Coke Company.

[*Concluded from p.* 537.]

Electrical Arrangements.

These arrangements are substantially the same as in the case of the projector and ram machines; the current passing from the collectors into a double pole switch and thence, *vid* a single pole circuit breaker, to two distributing plates. From these plates two circuits are taken; one pair of wires going into the travelling-hoisting controller and one pair to connect to two of the three vertical banjo wires strained up the side of the outer frame. The control gear for the ram and the projector motors take their supply from these two wires by means of spring collecting contacts fixed on the inner frame; while the shunt current from the projector motor returns to the negative plate *vid* the third banjo wire, between which and the negative plate the adjustable rheostat is connected in circuit for the purpose of regulating the speed of the projector motor.

The arrangements for raising and lowering the inner frame are exactly the same as in the separate machines; the work being performed by the travelling motor through a clutch. In the case of the complete stoker, however, this motor is rated according to the extra load with which it has to deal, and is, as already mentioned, the exact duplicate of the ram motor—a practice which greatly reduces the number of motor and controller "spares" which it is necessary to keep. The regulator for controlling the speed of the projector motor is fixed on the outer frame; while the starting switch is fixed on the hanging frame at the back of the motor.

As in the case of the separate machines, an automatic tappet switch is connected in the main feeder cable, in order to ensure that, upon the travel of the inner frame exceeding the limits of safety, the current is automatically cut off. In connection with this switch it may be remarked that the safety appliance can be so arranged that, upon the arrival of the inner frame at either of these positions, the controller of the travelling hoisting motor can be automatically brought to the "off" position; but a tappet-operated switch performs the same desired result with a less degree of mechanical complication.

Maintenance.

The chief factor in the successful operation of electrically driven retort stoking machinery is cleanliness and efficient lubrication; and no effort should be spared to keep the entire machine in a reasonably clean state, and to see that all oil holes and grease cups are plentifully supplied with lubricant, particular attention being given to the projector drum, motor, and pulley bearings.

Another important portion of the machine to which special attention should be given in this respect is the shaft which passes through the centre of the hoisting worm and travelling pinion, and carries the clutch. In order that the portion of the shaft passing through the worm may be lubricated, two holes are drilled through the latter, one in the centre of each bearing and one in the clutch end of the worm, and a deep groove is cut in line with the worm in such a manner that, when the groove is on top, the oil holes are vertically under the Stauffer lubricator in the cap of the two bearings, and by screwing-down the caps grease can be forced direct on to the shaft.

The clutch, which is controlled by one handle, serves to put either the hoisting or the travelling gear into operation, or, if desired, it can be put into a neutral position and the motor run idle. Care should be taken to engage the respective motions without any undue shock; this being best accomplished by placing the clutch in the neutral position and throwing the controller handle to the first notch and back again to the off position as soon as the motor starts to turn around. Just as the motor is on the point of stopping, the clutch lever should be thrown sharply over to the desired position, when it will be found that the clutch will fall quietly into gear without any undue shock. The practice of holding the clutch hard-over in the required position and then engaging it by starting the motor is a pernicious one, and can only result in damage to the machine.

Too much emphasis cannot be laid on the importance of frequent inspection of the machine and all gearing. By this means, and by intelligent observation of the behaviour of the machine when under load, it is possible to detect and rectify incipient faults which, if allowed to go unnoticed, will result in a stoppage. The motors in the machines work in extremely dusty places, and there is always a tendency for oil and coal dust to gather inside the carcase of the machines. Such accumulations form a most destructive mixture, which tends to perish the insulation on the field and the armature windings and afterwards to support the short-circuit brought about in this manner between the windings and the frame of the machine. The motor casings and controllers should be blown out every day by means of a pair of common bellows, and afterwards wiped out by a cloth (not cotton waste) moistened, if necessary, with methylated spirits.

The projector-motor is particularly liable to suffer from lack

of attention in this respect, owing to the cramped dimensions of the box it is housed in. The brushes and their holders should be examined daily, there always being the possibility of their working loose and causing damage to the armature by coming into collision with its windings. The oil in the motor bearings (particularly the bearings of the projector motor) should be frequently changed; it being by no means unusual for fine dust to work into these bearings. The motor controller and resistance connections should be gone over daily, in order to make sure that they are perfectly tight, and the projector regulating resistance should be carefully examined for loose connections, as an open circuit occurring on the field of an excited shunt-wound motor may easily bring about the destruction of the machine, to say nothing of causing injury to an operator.

Should the speed of the projector motor become excessive and the motor spark badly at the brushes, it is due to an open circuit, or partially open circuit, in the field, and the connections of the same should be examined throughout—coils, rheostat, and banjo wire collector. The same care should be taken if the motor is noticed to attain any unusual speed on any particular point of the regulating resistance. Such an occurrence is due to a weak field, and is invariably accompanied by an abnormal armature current; and the fault should be located and remedied before this current results in a "burn out" of the armature.

It sometimes happens that when the projector motor is being speeded-up for charging a retort, the hold-up magnet upon the starter releases the radial arm and allows the starter to fly back to the off position. This is usually due to poor magnetic contact between the poles of the hold-up coil and the small pole piece attached to the starter arm. Sometimes these fitments may have worked loose and require readjusting; while at other times the trouble is only caused by the presence of a little rust or dirt.

The overload release of the starting switch must be loaded up sufficiently so as not to cause a release of the arm due to the momentary rise of current when speeding-up the projector. The setting which is usually found to give satisfaction on a 230-volt circuit is about 25 to 30 amperes. It sometimes happens that the release spring gets bent and remains in contact, thus permanently short-circuiting the hold-up magnet. This is the first point that should be noted should the no-volt coil fail to hold up. The banjo wires strained up the side of the machine for the purpose of conducting current into the hanging frame should, with their collectors, be cleaned daily, and all accumulations of coal dust and dirt carefully removed from the insulators at the top and bottom of these wires.

General Remarks.

It not infrequently happens that when a new type of machine is put to work it is so unconsciously abused and mishandled during the first year of its use, owing to its characteristics not being fully understood, as to seriously detract from the period of its useful life. It must be borne in mind that many troubles that occur to heavy machinery of this class are due not so much to the machine itself as to the conditions under which it is put to work; and while these conditions can in most cases be rendered ideal if properly considered before the machine is erected, it is often impossible to alter, or even modify, them when once the machine has been delivered and put to work.

A matter to which too much primary attention cannot well be given is the design of the track on which it is meant to work the new machine. Under this heading it must be remembered that the track is subjected to a strain which, so far as the author is aware, is peculiar to this class of undertaking—namely, the back-thrust brought about by the action of the ram on the caked coke in the retorts. A very common error is to utilize an existing set of rails on the charging side of the benches without giving proper consideration to the question whether they are of ample section, and sufficiently well supported and anchored, to operate satisfactorily under a machine weighing perhaps twice as much as the one, or ones, for which they were originally laid.

A well-designed track of ample rail section should be provided. In this connection, it will be found that the makers of the machine for their own sakes, are invariably willing and anxious to give advice on this all-important subject. A poorly-designed track is a source of continual trouble, and, from the writer's own experience, is responsible for those most annoying of all breakdowns—mechanical breakdowns to which no reason can be assigned, and which leave everyone concerned in a state of uncertainty as to when it is going to happen again, and with the uncomfortable feeling that, though the consequence has been remedied, the cause still exists, and may at any moment bring about a recurrence of the trouble and still remain undiscovered and shadowy—the subject of endless conjecture and theorizing.

Use of the Recording Ammeter.

One of the advantages incidental to electrical driving is the ease with which the energy consumed by any particular machine can be checked and, if necessary, recorded automatically by a recording ammeter fixed in the circuit. A meter of this description fixed in the stoking machine circuit will be found to give records of the greatest value if properly dated and filed away. The current taken by the machine on every operation will be registered by means of a line on the chart, and any unusual performance of the machine will be recorded against the exact time at which it took place. It will thus be seen that the recording ammeter will furnish a continuous record of the condition of the machine, the handling of the controller, and the state of the retorts and the character of their contents (shown by the current required for discharging them taken by the ram motor).

Smooth and efficient working can be greatly facilitated by co-operation between the carbonizing foreman and the electrician in charge of the plant, as the latter, if advised from time to time as to the state of the contents of the retorts, can alter his circuit breaker according to the varying nature of the coke. With certain coals it will be found that the maximum current taken on the discharging stroke is greater than with others; and while such cargoes are being worked through, much delay may be avoided by setting the circuit-breaker a little higher.

Other factors which are closely connected with the satisfactory operation of machines of this general class are: (1) The arrangement of feeder wires, (2) the training of operators, and (3) the selection of switchgear. While a careful consideration of these points is essential to the production of a useful article, the author does not desire to repeat much of that which he has already written in former articles, and will content himself with referring interested readers to those articles. While not dealing directly with "D.B." retort machines, the points raised are really applicable to any type of electrically driven charging or discharging machinery, and will be found to have been comprehensively handled in the following issues of the "Journal:" April 14 and 21, 1914, Jan. 12, 19, and 26, 1915.

In conclusion, the author desires to express his thanks to Messrs. W. J. Jenkins and Co., Limited, of Retford, the makers of the "De Brouwer" machines forming the subject of this article.

INSTITUTION OF WATER ENGINEERS.

The Twentieth Winter General Meeting of the Institution was held last Friday, at the Apartments of the Geological Society, Burlington House, W. The President (Mr. F. W. M'Cullough, M.Inst.C.E., of Belfast) was in the chair; but the attendance, owing to the war, was not large.

The Majority of the Organization.

The President, in opening the proceedings, commented on the fact that this was the final meeting of the twentieth year of the existence of the organization; and so next year the Institution (which was established as the British Association of Water-Works Engineers) would attain its majority.

Minutes and Accounts.

The Secretary (Mr. Percy Griffith) read the minutes of the last summer meeting; and they were confirmed.

The President submitted the annual accounts; mentioning that there was a balance of £88 18s. 2d. on the right side as the result of the year's working.

The accounts were adopted.

Office-Bearers.

Mr. G. T. Edwards and Mr. W. R. Jenkins were appointed Scrutineers of the balloting list, and later reported the following elections:

President: Mr. F. W. M'Cullough, Belfast.
Vice-Presidents: Mr. A. B. E. Blackburn, of Sunderland; and Mr. S. C. Chapman, of Torquay.
Ordinary Members of Council: Mr. J. C. Barrowclough, of Batley; Mr. F. J. Dixon, of Ashton-under-Lyne; Mr. H. C. Head, of Winchester; Mr. C. B. Newton, of Hull; Mr. H. Preston, of Grantham; Mr. C. H. Priestley, of Cardiff; Mr. C. H. Roberts, of Aberdeen; Mr. E. J. Silcock, of Leeds and Westminster; Major H. W. Woodall,* of Bournemouth; and Mr. William Matthews, of Westminster.

[* On Active Military Service.]

The constitution of the Council is the same as before, with one exception—Mr. Matthews taking the place of Mr. A. J. Jenkins, of Jersey.

Moved by the President, and seconded by Mr. A. B. E. Blackburn, Messrs. Wood, Drew, and Co. were appointed Auditors, with Messrs. Arthur Valon and W. J. E. Binnie, B.A., as Honorary Auditors.

The Definition of "Domestic Purposes."

A paper, entitled "Notes on the Definition of the Term 'Domestic Purposes' in General and Private Water Acts," was then submitted by Mr. A. B. E. Blackburn and Mr. Percy Griffith. A long discussion followed; and a report of this, with the paper, will be published in an early issue.

Next Meeting.

The President, in reiterating the desire (expressed at the previous meeting) of his Committee and himself that the members should visit Belfast for their next summer meeting, said that the Council of the Institution had accepted the invitation provisionally, and would consider the details at their meeting next March.

A hearty vote of thanks was passed to the President and Council of the Geological Society for the use of their apartments.

THE PRODUCTION OF PHENOL IN GERMANY.

In an article in the "Zeitschrift für Angewandte Chemie," Dr. Raschig, of the Baden Aniline and Soda Works at Ludwigshafen, states that the details of a process devised by him for the extraction of carbolic acid from German coal-tar products have hitherto been kept secret; but in present circumstances this policy will no longer be adhered to. Hostile nations cannot profit by the disclosure, as the only countries besides Germany in which tar distillation has been developed are Belgium and Great Britain. The Belgian distilleries are now in German hands, and as English tars are much richer in carbolic acid than German, it has always been the practice of English tar distilleries to extract it.

Prior to the war, German requirements were chiefly met by the importation from England of crude carbolic acid, which was worked-up to various refined products. This was due partly to the greater richness of English tars in carbolic acid, and partly to the greater development of the English gas industry, which is shown by the fact that at the close of the last century the German production of coal tar was probably not one-third of that of Great Britain. The expansion of coke production in recovery ovens in Germany has, however, now raised the German output of coal tar at least to an equality with the English; but the German oven tars are comparatively poor in carbolic acid. Extraction of the latter from them had, however, progressed to such an extent that at the outbreak of war carbolic acid was obtained from about one-third of the German production of tar. The carbolic acid was left in the tar oils from the remainder of the tar, and was therefore wasted when these oils were used as fuel or solvents, or for preserving timber.

The cutting off of the English supply of carbolic acid to Germany which ensued on the outbreak of war led, Dr. Raschig explains, to a scarcity in the latter country, which was enhanced by the large demand for it for the manufacture of picric acid. As Britain as well as Germany has prohibited the export of carbolic acid to neutral countries, there is even greater scarcity of it in the latter; and this will be still more keenly felt after the conclusion of peace, when these countries again seek the supplies from Germany which they were wont to take. Hence Dr. Raschig regards it as a German national duty to work-up all the available supplies of carbolic acid. Plant is to be provided to distil off the carbolic oil fraction—which comes over generally between 170° and 200° C.—from the coal tar. This fraction contains between 25 and 35 per cent. of constituents soluble in alkali. Works are being erected to supplement those already existing for the extraction of the phenols from the tar oil by washing with soda lye. This can only prove remunerative in large works, because the soda extract has to be decomposed by carbonic acid into crude carbolic acid and sodium carbonate, and the latter has to be recausticized (for use again) by means of quicklime. The works therefore must have lime-burning and soda-causticizing plant, both of which are unprofitable unless worked continuously, which would be out of the question for a moderate sized tar-works handling (say) 200 tons of tar daily, and producing therefrom about 10 tons of carbolic acid.

Except therefore in the case of large tar distilleries handling 100,000 tons of tar per annum, the distilleries will have to collect the carbolic oils and send them to special works for extraction by means of soda lye. Dr. Raschig's process also utilizes the phenols contained in the light tar oils, now generally wasted; and a considerable proportion of phenol is also recoverable from the crude benzol of coke-oven works. Altogether it is estimated that from German gas tar, oven tar, and benzol 6000 tons of crystallized carbolic acid may be extracted per annum, whereas the present output is scarcely 2000 tons.

Another possible source of phenol is its synthesis from benzol by sulphonating and treating the sulphonate with soda. But this method of production would use up large quantities of benzol and sulphuric acid, both of which are at present greatly needed for other purposes. [This method of production is, however, described in detail by Mr. A. H. Ney in a communication of which an abstract, taken from the "Journal of the Society of Chemical Industry" of Nov. 15, is given below.—Ed. J.G.L.]

Abstract of Paper presented by Mr. A. H. Ney to the National Exhibition of Chemical Industry held in New York last September.

The communication dealt with the subject of "Synthetic Phenol and Picric Acid;" and the summary points out that up to the time of the Boer War synthetic phenol had only been produced in small quantities; but at that time, owing to the embargo placed on phenol, there was a considerable shortage on the Continent, and Herr F. Raschig commenced the manufacture on a large scale at Ludwigshafen, and has continued it since whenever the comparative prices of benzol and phenol made it remunerative. In America it had not been produced up to the outbreak of the present war, when Edison, who wanted considerable quantities for the production of the artificial resins used in making his phonographic disc records, took up the manufacture.

Manufacture of Synthetic Phenol from Benzol.—The benzol is sulphonated in a cast-iron vessel of 300 to 350 gallons capacity, provided with heating and cooling means, and connected to a reflux condenser. An agitating device is used, consisting of two oppositely mounted propellers on a vertical shaft or of one complete turn of a broad spiral, which is rotated in an open cylinder. Into the vessel 410 lbs. of 98 per cent. sulphuric acid and then 153 lbs. of benzol are run, and the agitator is started. The temperature rises to 62° to 68° C.; and when no further rise takes place, the vessel is heated to about the boiling point of benzol. The sulphonation takes about seven hours. The resulting sulphonic acid is run into a lead-lined vessel, and neutralized first with milk of lime and finally with waste calcium carbonate. The mixture is boiled for about thirty minutes (a little water being added if it becomes too thick); and then, after turning off the steam, water equal to one and a half times the volume of the original sulphonation mixture is run in. These precautions are necessary to ensure the calcium sulphate being in a suitable condition for filtration and washing. The mixture is pumped through a filter-press, and is washed with about 50 per cent. of its volume of water. The calcium benzenesulphonate solution is treated with solid sodium carbonate to convert it into the sodium salt. The precipitated calcium carbonate is used to neutralize the sulphonation mixture; the sodium benzenesulphonate solution is evaporated; and the product is dried and powdered. In a fusion vessel of about 300 gallons capacity 480 lbs. of caustic soda and 30 to 50 lbs. of water are melted, heated to 270° C., and 600 lbs. of dry sodium benzenesulphonate added. The temperature rises to about 300° and is finally raised to 315° C., when the heating is stopped. A slight further rise of temperature takes place, and the operation is complete when all the sodium salt has dissolved, and the melt becomes thin. The product is ladled out into shallow trays, cooled, roughly crushed, dissolved in water, and treated with dilute sulphuric acid until the evolution of sulphurous acid begins. A lead-lined vessel is not necessary, as only sufficient acid to form the bisulphite is used. The sulphurous acid is blown out with air, and the crude phenol separated and distilled. The crystalline phenol obtained frequently possesses a disagreeable odour, due to sulphur compounds, which can be removed by digesting or distilling the crude phenol with animal charcoal. Many so-called improvements have been proposed, but have not been successful in practice.

Manufacture of Picric Acid.—Technically, two methods are employed: (I) Phenol is first sulphonated and then nitrated with a mixture of nitric and sulphuric acids; (II) chlorobenzene is nitrated, the dinitrochlorobenzene formed is heated with caustic soda, and the resulting dinitrophenol is nitrated. The first process is most generally used, and is carried out as follows: One part of phenol is sulphonated with four parts of 98 per cent. sulphuric acid in a large steam-jacketed vessel provided with an agitator. The resulting sulphonic acid is treated in a nitrating vessel, provided with cooling and heating coils, with an equal amount of sulphuric acid cooled to 20° C.; and the nitrating acid, usually a mixture of equal parts of nitric and sulphuric acids, is run in. Instead of the three molecules of nitric acid required by theory, four are used. The contents of the vessel are kept below 40° C., while the first 30 or 40 per cent. of the nitric acid is added, and raised gradually to 70° or 80° C. The contents are then transferred to a non-metallic acid-proof vessel, and diluted with an equal volume of water. The crystals which separate on cooling are drained on a vacuum filter. A purer product is obtained by melting the crystals and running the melted material through a sieve of gold or platinum into cold water in a wooden tank. Large makers of picric acid use a filtering box, in which a vacuum can be applied both above and below. The crystals are first drained by the vacuum, and then washed with alcohol spray, which removes the resin formed in the nitrating process. A cover is then put on, and vacuum applied above so as rapidly to dry the crystals.

The Institute of Arbitrators.

Members of those professions whose services are usually invoked for the purpose of acting as arbitrators have combined to form, both for their own benefit and in the interests of the general public, an Institute of Arbitrators; and this new Institute—the President of which is the Right Honourable Lord Headley—has now started a "Journal," to be published quarterly, at No. 32, Old Jewry, E.C. The first issue of this new publication opens appropriately with an explanation of the aims and objects of the Institute, one of which, it is noted, is "to provide means for testing the qualifications of candidates for admission to the professional membership of the Institute by examination in theory and practice," and another "to promote and encourage the practice of the settlement of disputes by arbitration." The minimum age for admission to membership of the Institute has been fixed at 21 in the case of associates, and 30 for the degree of Fellow. There is an influential Council, the members of which have been selected with a view to rendering it thoroughly representative of the various professions to which the Institute is intended to appeal. The "Journal" contains a number of articles of special application to the subject of arbitration, as well as a report of the proceedings, which were formal in character, at the first annual meeting of the Institute.

The "Bulletin of Agricultural and Commercial Statistics," dealing with the international movement of chemical manures during the first half of this year, says that, regarding sulphate of ammonia, Great Britain exported during the first six months of 1915 a total of 162,543 metric tons, as against 318,914 tons for the whole of 1914, and 328,238 tons for 1913.

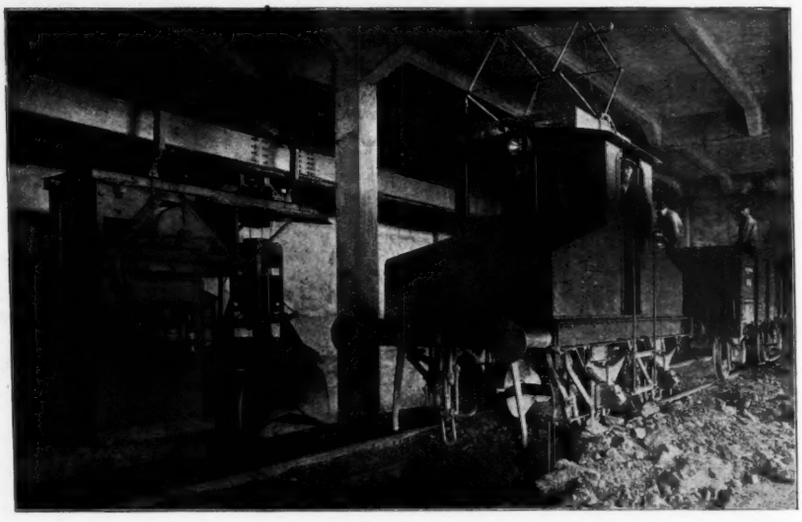
EXTENSIONS AT THE MAESTRICHT GAS-WORKS.

Carbonizing in Chamber Ovens.

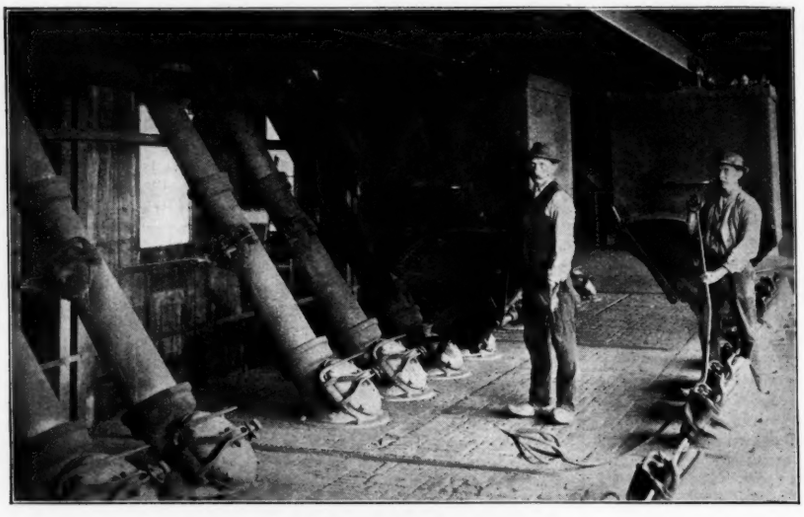
NEW carbonizing and auxiliary plant at the Maestricht Gas-Works has been erected on a site of about 10 acres, divided into two parts, one of which is 20 feet higher than the other.

On the lower portion of the site, a railway siding connects the new plant with the old gas-works. This siding runs up to the higher ground, where there is a connection with the coal-stores. The railway is electrically operated, by motors capable of drawing a train of 60 tons weight, at a speed of 2½ miles per hour. The direct current for operating the motors is delivered overhead, and is furnished from a transformer which also supplies current to the telpher system.

The coal-storage is of a total capacity of 2900 tons, and is divided into seven bunkers. Above these bunkers, and directly under the flat roof of the store, there is a railway-viaduct, the upper side of the rails on which are 20 feet above the lower works level. The bottoms of the bunkers are inclined, in the case of six of them, under 35°, and the seventh under 45°. The coals are pushed by hand from the waggons into bunkers. The bunker having the greatest bottom inclination is situated above a conveyor, which takes the coal from the shoot of the bunker to the breaker. The coal breaker and conveyor are operated by a rotary current motor of 7½ H.P. The coal-breaker has a capacity of some 20 tons per hour.



Electric Locomotive and Coal-Grab at the Maestricht Gas-Works.



Charging the Chamber-Ovens.

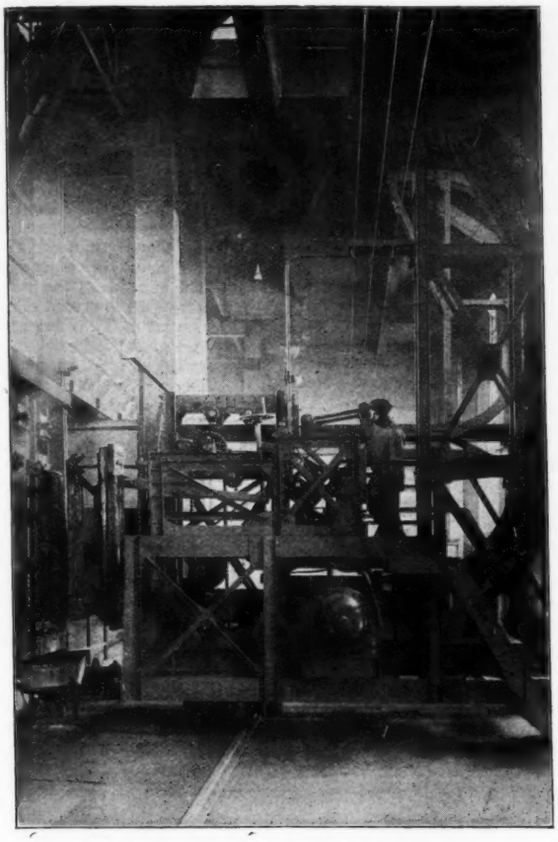
The broken coal falls into the shoot of an elevator which transports it to a high-level bunker, of a capacity of 100 metric tons of coal, and constructed in a special concrete building, between the coal-store and the carbonizing house. This building is also arranged to accommodate the boiler plant and water-tanks. Thus it is possible to take the coal from the railway-waggons, break it, and place it in the high-level bunkers, without manual labour.

For the transport of the coal from the six storage bunkers to the seventh bunker, there runs through the store an electrical overhead monorail, the upper side of which is 35 feet above the lower ground level. To the telpher car there is attached a grab, raising a metric ton of coal at a time. This grab is also used for transporting coal to a smaller bunker placed in line with the coal-store. But as this small bunker has no special breaking plant, a screen has been provided on which the grab is emptied. The large lumps of coal that happen to remain on the screen are then broken by hand.

The retort-house is of concrete, and has a superficial area of 120 feet by 215 feet. It contains five horizontal large chamber-ovens, in two groups of three and two ovens. Each oven has four chambers, 17 ft. 6 in. long, and is equal to taking a charge of about 3½ tons of coal. The carbonizing period extends over 24 hours, during which time, with first-class coals, the production per oven amounts to 157,500 cubic feet of gas. The chambers are charged by means of two hoppers, suspended from an overhead rail. The coal is discharged from the high-level bunker into these hoppers, which are moved easily by one man to the charging openings of the chambers. The ovens have a common chimney-stack 130 feet high, and 5 feet internal diameter.

The removal of the chamber-doors, the pushing out of the coke, and the levelling of the coal, is performed by an apparatus made by the Dillinger Engine-Works, Franz Méguin, at Dillingen (Saar). This apparatus is driven by a rotary current motor of 21 H.P., and is worked by one man. On the coke side of the ovens, the doors are moved by a hand-operated car, serving at the same time as a coke-pushing car, for taking the coke to the quenching-shoot. The charging of the ovens is carried out every 24 hours by five men—one to work the pusher and leveller, one for opening and shutting the doors on the engine-side, two for the same work on the coke-side, and one for charging the chambers and cleaning the ascension-pipes. The charging generally occupies not more than ten minutes. The quenching-shoot is of concrete, covered with cast-iron plates; and on gratings upon the lower side the coke is quenched by jets of water. Under the lower side of the quenching shoot a car runs, operated by a chain. The car is provided with a vertical shoot, enlarged at the upper end. Down this shoot is lowered an iron bucket, suspended from an electrical telpher. The telpher runs along the quenching shoot and the coke-storage ground. By means of a lever, arranged on the car with the shoot, the doors of the coke-quenching shoot are opened; and the coke falls down the car-shoot, into the iron bucket suspended therein. When the bucket is full, it is raised, and transported by the telpher to the desired spot on the coke-heap, where the bucket is emptied. As the railway crosses the telpher line, it is possible to discharge

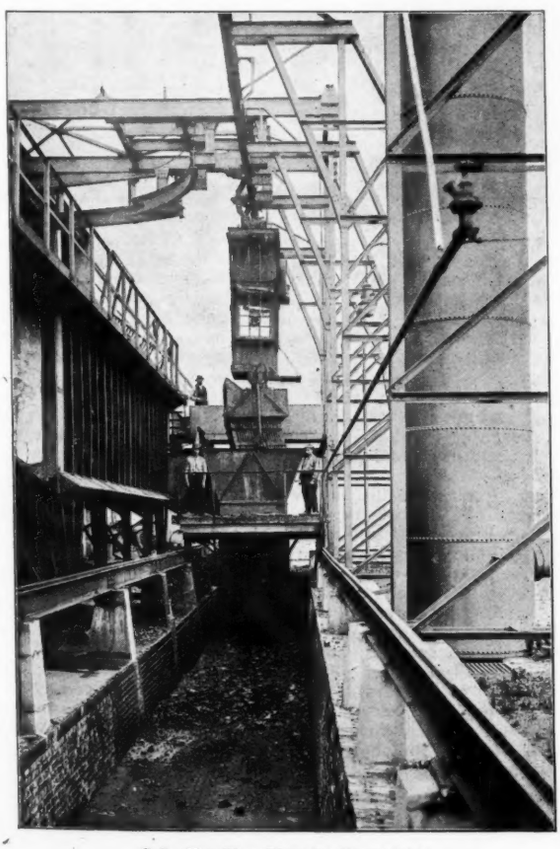
Coke-Cake leaving the Oven-Chamber.



The Coke-Ram at the Maestricht Gas-Works.

the coke-bucket immediately into railway-waggons without entailing any extra cost.

The coke-telpher is connected by a switch to the telpher in the coal-store, which allows of the discharging of coal from railway-waggons with the grab bucket, or of filling the waggons with coke from the heap by means of this grab. Both telphers are of the same pattern, so each car can take the place of the other. The telphers are operated by the workman who manipulates the coke-ram and levelling apparatus. During the charging of the coke-bucket, assistance is given by two of the stokers. The quenching and the transporting of the coke occupies some 15 minutes for each chamber.



Coke-Handling Plant at Maestricht.

The charging of the producers is done by hand, with a bogey, charged from a coke-bunker, and emptied through the bottom. The hydraulic mains are on the upper side of the ovens, and easily accessible by means of a concrete stage floor. The pipe condenser is inclined on a special stage in the upper part of the retort-house, and is also accessible by means of a concrete staircase. The gas passes through an annular air-condenser and an underground main to the exhauster-house, situated 100 feet distance from, and parallel to, the retort-house. Here there are arranged the exhausters, the tar-extractors, naphthalene-washer, and ammonia-washer, from the old works, all of 900,000 cubic feet per day capacity. The gas, freed from tar, naphthalene, and ammonia, is taken through a 16-inch main 2000 feet long to the purifier-house of the old works. From the old works, a 5-inch pipe supplies purified gas to the new works for the lighting of the plant and for heating and power purposes. The power for the exhausters and the washers is obtained from two 26 H.P. gas-engines.

Discharging Coke from the Coke-Bucket.

The lighting of the retort-house, the coal-store, and the yards is by means of high-pressure and low-pressure gas. The tar and ammoniacal liquor are collected in concrete tanks. Electric current is taken from the municipal system, and transformed to meet the requirements of the works.

Use of Gas Lime in Agriculture.—In the course of a letter to the "Newcastle Daily Chronicle," on the use of lime as a check to "finger-and-toe" disease in swedes and turnips, Mr. Douglas A. Gilchrist, of Armstrong College, quotes five dressings which have been found to be effectual, applied for the previous oat crop, before ploughing the ley. One of these dressings consists of 4 tons per acre of gas lime, the cost of which is put at about 12s. The writer says gas lime so applied is a great help, though not so effective as lime mud, in checking the disease; but it "is usually the most effective in helping the succeeding oat crop, probably because of the small amount of nitrogen it contains. Gas lime should be very carefully spread on the hay stubble, and all lumps broken and spread. Ploughing should not be done until at least six weeks after the gas lime is applied. Exposure to the air for this time renders harmless the small amount of poisonous matter. As gas lime can now, and for the next few weeks, be obtained at a very low cost, farmers who fear finger-and-toe disease on turnips are strongly advised to take advantage of this low cost, and to apply gas lime as directed. Its use may also be helpful to a certain extent in checking attacks of leather jacket grub or wireworn on the oat crop."

GAS V. COAL FOR DOMESTIC PURPOSES, AND THE CAMPAIGN AGAINST THE KITCHEN RANGE.

By W. L. Westbrook, of the North Middlesex Gas Company.

[A Paper read before the London and Southern District Junior Gas Association, Dec. 10.]

The progress made during the past few years in the efficiency of gas-fires and circulating boilers, together with the continued and increasing popularity of the gas-cooker, the high price of coal and uncertainty of the coal market due to strikes, &c., and the acuteness of the domestic servant problem, have combined to make the "All Gas" kitchen range a practical proposition.

Introduction.

When the first illustrations of combined gas-ranges appeared in manufacturers' catalogues some few years ago, the idea of ousting the kitchen range at once appealed to the writer. But the high initial cost of the apparatus, and the inaccessibility of the units for cleaning and repairs, were obstacles to the development of the idea. It then suggested itself to arrange a combination of cooker, boiler, and fire from apparatus already on the Company's hire or hire-purchase list, pull out a kitchen range, and fit them in its place. The consent of the Company's engineer having been obtained, and an order secured from a progressive consumer who was anxious to save labour and be in the van of progress, the first installation was put in hand and duly completed in December, 1913. It has proved satisfactory to both consumer and Company. Eleven complete installations have since then been fitted—four in new houses to order, and seven in place of coal-ranges that have been pulled out and scrapped. In addition, about fifty coal-ranges have been put out of action by fixing a gas-fire in front of the fire-bars, or sealing-up same.

There is not the slightest doubt as to the attractiveness of the proposition from the housewife's point of view; she has never loved the kitchen range as a piece of apparatus, owing to the amount of unpleasant work involved in keeping it in working order. The gas canvasser can score plenty of boundaries on the points of convenience and labour-saving when he suggests the installation of a gas-range and the scrapping of the old coal-range. The first thing in the morning you may put the kettle on the gas-stove and light-up the circulator; and by the time it would take to lay and light the fire in the coal-range, and get it up to working order, you will have a good supply of hot water available and the breakfast cooked.

The ease of control of the gas-cooker is well known to the housewife; but the efficiency of the gas-boiler and the working of the thermostat preventing waste of fuel and maintaining a supply of really hot water available at any moment required, at small fuel cost, is a revelation. All fuel consumption ceases the moment there is no further need for it; and you have no ashes to clean up after, and no "field day" once a week cleaning flues—to say nothing of periodical visits from the sweep. Then the question of boiler cleaning and repairs is undoubtedly in favour of gas.

The gas-fire successfully deals with the question of warming the kitchen in winter and airing clothes. It should be fitted with a fire-guard. It will, I think, be pretty generally agreed (except, of course, by the coal merchants) that gas "has it" on the points mentioned.

Method of Fitting.

We now come to the fitting of the apparatus. In our first installation the method of carrying out the work was as follows. The hot-water system was drained, and the old coal-range and boiler pulled out by the builder; the flow-and-return pipes being cut off at a convenient point above the boiler. The opening was then enlarged to the size necessary to accommodate the new gas apparatus, the fitter in the meanwhile being employed in running the gas supply. The estimated maximum consumption being about 160 cubic feet per hour, a 1-inch supply-pipe was laid from the meter under the kitchen floor across the front of the range opening; a ¾-inch branch across the floor in the centre of the opening supplied the cooker; and another ¾-inch pipe from the end of the 1-inch pipe was extended up the centre of the right-hand jamb to the level of the boiler connection—the pipe being chased-in and a ¾-inch by ¾-inch centre tee left at the correct level for the fire connection. The points were then plugged; and the work being tested by pressure-gauge, the floor boards were re-laid. To support the boiler, two pieces of ¾-inch iron barrel were let into the brickwork at the back of the opening, and fitted with front legs with flanges at the bottom, to ensure a good steady bearing. This stand was so arranged that the base of the boiler should be just above the top of the fire; the latter being raised on a shaped wood stand covered with sheet iron, so that the top was level with, and formed a continuous line with, the crown plate of the cooker. The legs of the boiler-stand were sufficiently wide apart to allow the flue from the fire to pass between them.

The cooker and fire were placed in position temporarily, and packed-up to the correct floor-level, in order to get the measurements for the flue-pipes, which have to be specially made for the job. In the first installation, however, this only applied to the flue from the fire, which was made with an obtuse elbow at the back; the flue being chased-into the brickwork flush, and supported by straps. The boiler was then placed in position, temporarily packed to the correct level, the flow-and-return pipes fitted, and the cooker connected-up *pro tem.* A 1¼-inch by ¼-inch iron bar drilled to take ⅜-inch bolts at intervals of about 1 foot was let into the brickwork at the top of the front of the opening, to support the adjustable register.

The whole of the apparatus was now disconnected and removed, and the floor, sides, and back of the opening rendered with cement, and the chasings stopped. This work completed, and the cement thoroughly set, everything was in readiness for the final stage of the work. The cooker was now permanently connected; the oven supply pipe having been first altered from the right to the left hand side. As the opening in this case was only 39 inches wide, it was necessary to fix the fire right up to the cooker, to keep within the available space. A ⅛-inch iron plate was now fitted on top of the boiler stand; and the left side of the plate was bevelled off to nothing and took a bearing on the crown plate of the cooker—being cut to fit round the brackets. The back and right-hand sides of the plate were fitted close up to the brickwork, and the front edge turned down at a right angle, about 1 inch, to form a level bearing for the back of the fire, which was securely screwed to same. This arrangement entirely closed the whole space on the right of the cooker in addition to making a good stand for the boiler, which was now finally lifted into position, and the flow-and-return pipes, flue, and gas connection fitted.

As arranged, in order to save the cost of tiling, the opening was now lined with sheet iron, which was fitted so as to form a continuation of the front and side walls of the boiler, and entirely encased the boiler connections, flue, &c. The flue from the oven of the cooker and the register having been fitted, and the gas supply connected to the fire, a coat of aluminium paint on the lining completed the job. As may be gathered from the description given, a good deal of scheming and difficult fitting was necessary; and several unforeseen obstacles had to be tackled before we were assured of success,

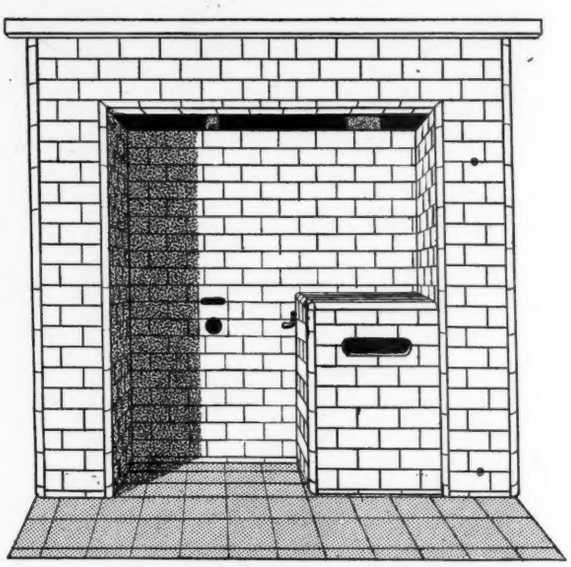


Fig. 1.—Tiling Ready for the Apparatus.

Our later improved installation, with the boiler standing on a tiled brick pier through which passes the flue of the fire [fig. 1], is much easier to fit, and also a much better job, than the close grouped installation; the only advantage of the latter being that it can be fitted in small openings. The method of fixing is substantially the same, except that the sheet-iron lining and boiler stand are dispensed with; the gas supply being arranged exactly as before. Both the oven and fire flues are at the back of the tiling, and are oval in section, to economize space. They are extended about 1 foot above the register; the tops being bevelled off from front to back, and the back portion bent forward to an angle of about 135° to prevent any loose mortar falling into the pipes. The cooker flue pipe is terminated at the lower end by a rectangular box about 1 foot long by 6 inches wide. The lid of this box is fitted outside the tiling, and carries the pipe connecting with the nozzle of the cooker; the bottom of the box being open to serve as an anti-down blow and cleaning door, and incidentally to prevent too great a pull and consequent loss of heat from the oven. Another advantage of the box is, should it become necessary to exchange the cooker, any variation in the height or shape of the flue can be met by fitting a new lid, and so save disturbing the tiles. Figs. 2 and 3 show the general arrangement of the flues and gas supplies completed and ready for covering, and fig. 4 shows a completed installation as now fitted. The dimensions of the opening necessary for this installation are: Width 4 feet, depth 2 feet, height 5 feet. The 4 feet will allow ample room for cleaning on both sides of the cooker.

Troubles, and how they were Overcome.

I am glad to say that, up to the present, complaints in respect of these installations have been practically *nil*; but there were

one or two minor troubles which had to be dealt with and overcome that may prove of interest. In passing, I may mention that, from a hygienic point of view, the arrangement is, in my opinion, a great advance; the whole of the products of combustion from the cooker, fire, and boiler passing away cleanly into

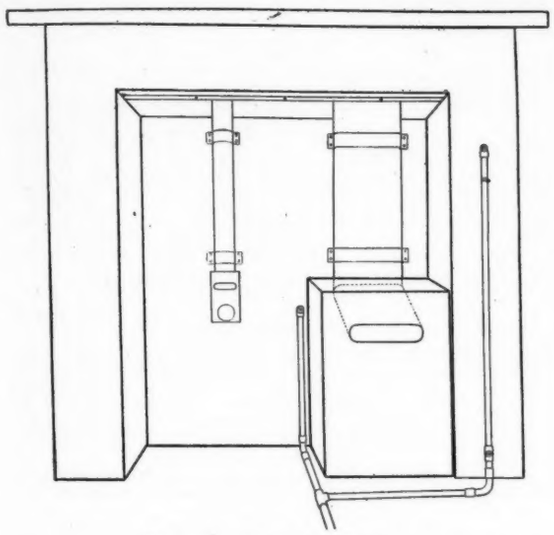


Fig. 2.—Arrangement of Flues.

the chimney, in addition to the greasy vapours given off in the process of cooking. The adjustable opening in the register above the hot plate of the cooker proved very successful in dealing with the waste gases from this source.

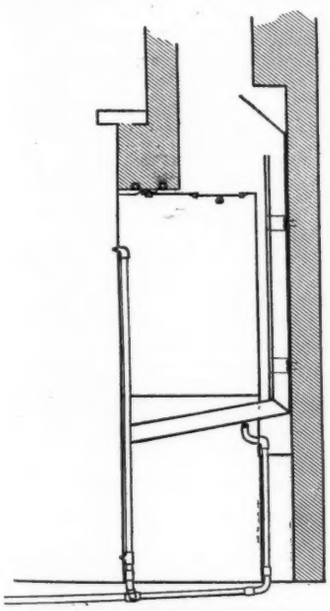


Fig. 3.—Flue and Gas Connections.

It was, perhaps, owing to the pull on the flues being rather excessive that we experienced our first trouble—viz., the circulator burner being put out after the thermostat had come into operation. This happened at intervals; and from the first we attributed the trouble to the keen draught, which, of course, varied with the weather. We increased the amount of gas passing through the bye-pass, and drilled holes in the sheet-iron boxing, in order, by bye-passing some of the air, to ease the pull through the boiler, at the same time opening the register to the full extent. The trouble, however, continued. Finally, we tackled the chimney-pot, and by cementing a flower-pot into the chimney-pot (an old dodge) we found we had practically stopped the up-draught altogether. Then, by gradually enlarging the hole in the bottom of the flower-pot, we succeeded in getting sufficient pull to remove the products of combustion without excessive draught; and there has been no further complaint of the bye-pass being extinguished. This trouble occurred on two separate installations; the same remedy proving successful in each case.

Another of our troubles was a little problem in hot-water work, which announced itself during testing operations after the completion of the installation. I may here digress for just a moment to remark that the advent of the gas circulating boiler seems to have exposed some defects in hot-water systems that were previously not suspected, and emphasized others. The vagaries of intercirculation are now well known, with the shutting-down of the thermostat when the gas-boiler is out of action. In spite of this, I believe illustrations are still abroad showing how conveniently a gas circulator can be connected to the existing flow-and-return pipes from the range-boiler, by right-angle tees, fitted about 6 feet away from the kitchen boiler to the vertical pipes in the chimney-breast recess. While on the subject of connecting to existing flow-and-return pipes, it should not be overlooked that, where a gas-boiler is so fixed and the draw-offs are from the flow-pipe, if the range-fire is out, mixed water is quite likely to be drawn.

To return to my subject. The installation in question comprised a 35-gallon rectangular hot storage tank, which was fixed in an attic on the second floor, almost immediately over the kitchen. The 1-inch cold supply entered this tank at the side quite close to the bottom, without being properly trapped. The cold storage tank was fixed almost immediately over the other.

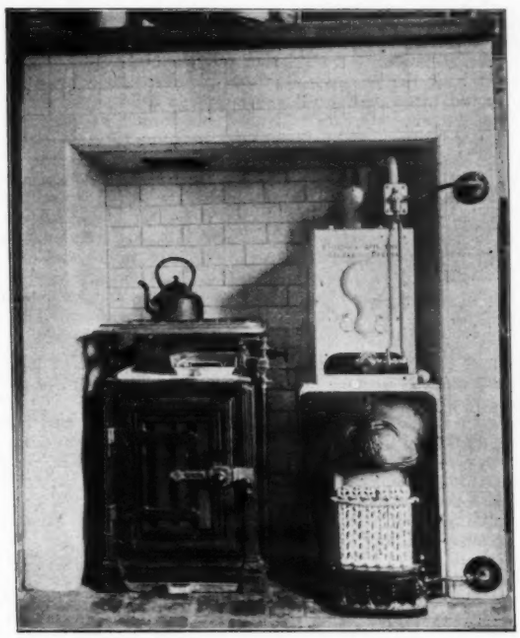


Fig. 4.—Combined Gas Cooker, Boiler, and Fire Installation.

There was about 50 feet of 1¼-inch flow-and-return pipe, nearly all of which was rising vertically, to within about 4 feet of the tank, from which point it was almost level. From the flow-pipe, about 4 feet above the boiler, there was a secondary ¾-inch circuit heating a radiator in the linen cupboard, and returning again to the flow-pipe; one tee being fixed just above the other. The draw-offs were all taken from the expansion-pipe. The gas-boiler fitted was adjusted to consume 80 cubic feet of gas per hour.

On lighting-up the boiler, all went well. The flow-pipe became very hot, the whole of the storage was heated in good time, the circulation completed, and the thermostat shut-down, and we thought the job was finished. A few gallons of water were then drawn off to test the thermostat; but there was no sign of the gas coming on again. To make a long story short, we could draw the

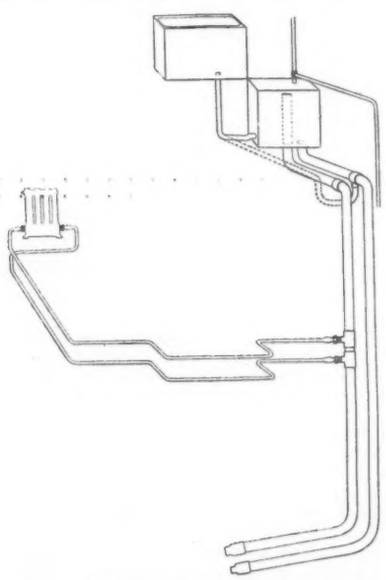


Fig. 5.—Details of Hot-Water Installation.

whole 35 gallons of hot water, and the return pipe was, if anything, hotter at the end of the draw than before. The cold water simply defied the law of gravitation, and would not come down. The thermostat we knew to be in order. On testing the water in the cold storage tank, I found it to be 70° Fahr., or about 10° higher than it should have been, due to the untrapped cold supply to the

hot storage. But this would not account for the trouble. The man-hole lid having been removed from the hot tank, the flow-and-return connections were found in order; and as there was no doubt the return pipe continued to get hotter, suspicion fell on the boiler, which it was thought might have reversed the circulation in some mysterious way. Another theory was that, with such alarge amount of 1¼-inch vertical pipe already hot and the circulation suspended by drawing off, the upward pressure was overbalancing the downward pressure of the cold water and thus preventing it descending.

To decide the matter, the boiler was at once exchanged, being charged with the offence. But on the new boiler behaving in exactly the same manner, the suspect was discharged without a stain on its character. The 1-inch cold supply was now cut off from the tank, trapped, and teed into the 1¼-inch return pipe, and upon re-testing the cold water at once descended after the drawing-off of about one gallon, and the thermostat responded. In face of this result, I shall be interested to know if any gentleman can support my second theory; if not, can he enlighten me as to the cause of the trouble? There is in my mind no doubt that this phenomena existed when the range boiler was in use; but it was the gas-boiler, or rather the thermostat, that exposed the fault. Fig. 5 shows the details of the hot-water installation in question.

Initial Costs of Installation.

We now come to the financial aspect of the question, and, as in all commercial propositions, there are the important points of initial and working costs, repairs, and depreciation.

Builder's Work.—Pulling-out the old kitchen range and boiler, cutting-off flow-and-return pipes, doing necessary cutting-away of brickwork, building-up around flues and stand for boiler, rendering and tiling opening, floor and jambs. This will vary somewhat with the size of the opening, and costs from £4 to £5. In new buildings, of course, the cost of pulling-out the old range and cutting-away is saved.

Fitter's Work.—Laying gas supply pipes, fitting cooker, boiler, and fire, making and fitting special flues for same and adjustable register for opening roof, connecting boiler to existing flow-and-return pipes (assuming same are properly installed), altering draw-offs from flow to expansion pipe if necessary, making good, and testing. [In new buildings the flow-and-return pipes were run and connected to the storage tank. The draw-offs and the rest of the hot-water installation, including the fixing of the tank, was done by the builder's plumber.]

The average net cost to the Company of the above fitting work was, taking the average of three installations, in new buildings, £4 1s. 8d. each; and in two cases in which the coal-ranges were pulled out, £5 11s. 10d. each. Thus, adding the builder's and fitter's work, the net fixing costs of an installation to the Company were: In new buildings, approximately, £8 8s.; in cases where coal-ranges were pulled out, £10 10s.

Costs of Cooker, Boiler, and Fire.

The costs of these will, of course, depend on the apparatus selected, and may therefore vary greatly. But we have not in any of the combined ranges installed the cheaper two-section boilers, or one burning less than 60 cubic feet of gas per hour. The net cost of the appliances shown—viz., a four-section boiler, with gas consumption of 60 cubic feet per hour, an intermediate grade cooker with 14-inch oven, three boiling burners and grill, and a 10-inch gas-fire, would be approximately £9 4s. But, as previously stated, this will vary according to the individual consumer's requirements.

The initial net cost of the installation and fitting, based on the above figures, will therefore be:

In new buildings (say)	£17 12
In cases where coal-range is displaced	19 14

Compared with the above, it would cost a consumer from £10 to £12 to pull out a 3 ft. 6 in. kitchen range and instal a new one.

For big families a larger cooker is advisable, as there will be no kitchen range available; and in cases where over 30 gallons storage of hot water are required, I think it would be advisable to instal a boiler consuming 80 cubic feet of gas per hour. But with gas, if the boiler is large enough, such quick results are obtained that for ordinary domestic use in villa residences—with (say) draw-offs supplying one bath, two lavatory basins, and scullery-sink—30-gallon storage should prove ample; and should the storage exceed this, it would pay to cut it down by altering the return pipe connection to the tank by the now well-known method. In deciding the size of boiler, any secondary flows and returns, towel-rails, &c., should be noted and allowed for, if they are to remain in action. It must not be forgotten, however, that they mean increased heat loss, and consequently a higher consumption of gas. An independent gas-heated, towel-rail, or, where convenient, a draw-off taken through the rail, would be advisable. The case of a coil heating a linen cupboard, where the storage tank is elsewhere, is, of course, important; and care must be taken to see that it works efficiently.

Working Costs.

In the following figures of the working costs of installations, every care has been taken to ensure the information being as accurate as possible. The figures of the gas consumptions are, of course, exact, being taken from the meter-cards; but, in some cases at least, circumstances affecting the ordinary routine of the household discount their value. This is, unfortunately, impossible to avoid in making comparisons from year to year. It must also be remembered that at the present time people are keeping a closer watch on expenditure, and studying economy more closely than they did before the war. In the figures relating to coal consumed, the information was obtained direct from the consumer; and where not taken from actual invoices, it is given as "approximate consumption."

Consumer A.

Four in family, including maid.
Approximate rent of house—£45 per annum.
Appliances—combined range and Kern radiator in dining room.

	Cubic Feet.
Gas consumed per annum in 1912, previous to installation of combined range	28,600
Gas consumed per annum in 1914, after installation of combined range	49,900
Increase per annum	21,300

at 3s. per 1000 cubic feet = Increase in gas account of £3 3 11

Coal used in 1912, 3½ tons per annum approximately.
" " " 1914, 1½ " " " "

Coal saved equals 2 tons per annum approximately.

Say, 2 tons at 30s. = saving in coal account of	£3 0 0
Saving in repairs to boiler, sweep, wood, &c., say	1 0 0
Total saving	£4 0 0
Less	3 3 11
	£0 16 1

Remarks.—Circulator only used one day each week. Exceptionally careful consumer. This would, of course, apply to coal as well as gas.

Consumer B.

Seven in family.
Rental of house—£75 per annum.
Appliances—combined range and two 10-inch fires.

	Cubic Feet.
Gas consumed previous to installation of combined range Midsummer, 1912, to 1913	11,000
Gas consumed after installation of combined range Midsummer, 1914, to 1915	98,200
Increase per annum	87,200

at 3s. per 1000 cubic feet. = Increase in gas account of £13 1 7

Coal used in 1913 . . . 10 tons per annum approximately.
Coal used since installation of combined range . . 1½ " " "

Coal saved per annum. . 8½ tons per annum at present prices.
Say 8½ tons at 30s. = saving in coal account of . . £12 15 0

Increase in gas account	£13 1 7
Saving in coal account	12 15 0
Extra cost of gas	£0 6 7

Remarks.—Against the extra cost of 6s. 7d. must be placed the saving in boiler repairs, sweep, wood, &c. (say) £1, leaving a small balance in favour of gas. In the case of consumer B, two servants have been dispensed with since the combined gas-range has been installed. On the other hand, the consumption of coal given for 1913 was considered by the consumer to be rather abnormal, being due to lavish use by the servants at a period when they were not under usual supervision. Since the servants were dispensed with, the gas-range has been used by the consumer regularly; and the excellent results obtained are undoubtedly due to careful management. This, however, only shows what can be done by gas when it is used intelligently; and I submit that the figures given are eloquent in its favour as a domestic fuel compared with coal, after all allowances have been made.

Consumer C.

Four or five in family, including maid. Often have company.
Rental of house—£65 per annum.
Appliances—Combination range (installed 29/10/14*) 18-inch "Condor" fire lighting in kitchen, scullery, &c.
Gas consumed 1913: 32,100 cubic feet.

		Cubic Feet.
Gas consumed 1914.	March	15,300
	Midsummer	5,400
	Michaelmas	2,200
	Christmas	23,300*
		46,200
Gas consumed 1915.	March	43,200
	Midsummer	24,200
	Michaelmas	21,500
	Christmas (Estimated)	37,100

Say, 126,000 cubic feet per annum.

126,000 cubic feet.
32,100 "

93,900 cubic feet increase over 1913. Say, 94,000 cubic feet at 3s.=

£14 2s. 0d. increase in gas account.
Coal used 1913-1914, 10½ tons per annum approximately.
" " 1914-1915, 2 " " " "

Coal saved . . . 8½ tons per annum at present prices.

Say, 8½ tons at 30s. = saving in coal account of	£12 15 0
Increase in gas account	£14 2 0
Saving in coal "	12 15 0
Extra cost of gas	£1 7 0

Remarks.—From this extra cost of £1 7s., at least £1 must be deducted for cost of firewood and chimney sweep's charges, which, assuming no repairs

to boiler were to be met, shows the additional cost of gas over coal to be only 7s. per annum, while the extra convenience and labour saved are worth quite ten times this amount to the consumer. The consumer reports the installation as being very satisfactory. He has shown it to many friends, who are only prevented from adopting similar arrangements by the initial outlay necessary. He also says the old range was very wasteful; and he could not get hot water before adopting the gas-boiler. He was unable to have a second bath for hours after the first. The cooker is used regularly for three meals daily.

CONSUMER D.

Five in family, including servant.
Rental of house—£55 per annum.
Gas used throughout for cooking, hot water, and heating. No coal used. 15 per cent. discount.
Appliances.—Two geysers (one large and one small lavatory type). Cooker. Eleven fires (three 14-inch, one 12-inch, and four 10-inch). 21/9/14.*

		Cubic Feet.
Gas consumed 1912.	Ladyday	10,400
	Midsummer	13,400
	Michaelmas	8,300
	Christmas	9,700
		41,800
Gas consumed 1913.	Ladyday	12,400
	Midsummer	10,800
	Michaelmas	13,100
	Christmas	6,300
		42,600
Gas consumed 1914.	Ladyday	16,100
	Midsummer	15,200
	Michaelmas	10,200
	Christmas	60,600*
		102,100
Gas consumed Christmas, 1914, to Michaelmas, 1915.	Christmas, 1914	60,600*
	Ladyday, 1915	52,600
	Midsummer, 1915	26,700
	Michaelmas, 1915	11,200
		151,100
	Less	42,600
	Increased gas used	108,500

108,500 cubic feet at 3s. 4d. per 1000 cubic feet less 15 per cent. discount = £15 7s. 5d. increase in gas account.
Actual coal used per annum in 1913, 16 tons, which at 30s. per ton = £24 per annum for coal saved.

	£ s. d.
Decrease in coal account per annum	£24 0* 0
Increase ,, gas ,, ,, ,,	15 7 5
Saving per annum	£8 12 7

Against this must be placed the account for hire and hire-purchase of appliances on the one hand, while on the other we have again to allow for firewood, sweep's account, &c., saved.

Remarks.—The coal-range was a very extravagant one. Two servants less since coal was dispensed with; consequently no heating of kitchen necessary.

Comparison of Charges.

Interest on capital outlay at 10 per cent. per annum, and repairs and depreciation, as an annual charge.

GAS INSTALLATION.

	£ s. d.
Interest on (say) £20 at 10 per cent. per annum	2 0 0
Repairs and depreciation— Based on life of boiler, 10 years, per annum. ,, ,, ,, cooker and fire, 20 years, per annum	1 0 0
Giving an annual charge of	3 0 0

COAL-RANGE.

	£ s. d.
Interest on £10 at 10 per cent.	1 0 0
Repairs and depreciation— Based on life of range, 30 years. ,, ,, ,, boiler, 10 ,,	0 15 0*
Giving an annual charge of	1 15 0

* This figure would probably be much higher in hard-water districts.

To Summarize

The initial cost of the gas installation is higher than the kitchen range.
Working costs.—Judged on the figures I have been able to obtain, gas will, to say the least, compare very favourably with coal.
Depreciation and repairs.—Though in the figures above, the kitchen range has been given the benefit of the comparison, this item is such an uncertain quantity, it would have perhaps been wiser to leave it entirely alone. In some cases undoubtedly this item alone will be sufficient to cause the scrapping of the kitchen range, as was the case in one of the installations mentioned, in which the bill for repairs to kitchen boiler and pipes amounted to £19 in twelve months.
Benefit to the Gas Company.—Regular increased consumption.
Benefit to the consumer.—Great saving in labour, greater convenience, and cleanliness.

SPECIAL DISCOUNTS.

The Company I serve, in order to foster the movement, are allowing the consumers under a special agreement a discount of 10 per cent. off the whole of the gas consumed on the premises where all the hot water is obtained and the cooking done by gas exclusively, the kitchen range being either removed and a gas-fire fitted in front, or the range sealed-up, as before mentioned. In cases where gas-fires are fitted to every grate and no coal or solid fuel whatever is used, the agreement allows 15 per cent. discount.

I have to acknowledge, with thanks, the assistance of one of my fitting staff (Mr. Ernest Allen), who, in addition to being responsible for the photographs and drawings shown, carried out the actual fitting of our first installation. In conclusion, may I say: "Use Gas! Less Labour. Greater Comfort."

DISCUSSION.

The PRESIDENT (Mr. S. B. Chandler, of the South Suburban Gas Company) having invited discussion of the paper,

Mr. W. E. BROWN (Gas Light and Coke Company) remarked that the author had dealt with a subject which was every day before the distribution department. It seemed to him that more might often be made by gas men of the point about the unpleasant job of cleaning the flues of the kitchen range. Frequently servants refused to take a place where they would have to clean the flues of the kitchener; and now that domestics were so hard to obtain, this point should be emphasized when trying to get a gas installation in. For such installations as the author described, it would probably be necessary to confine one's self to cases where the house was the occupier's own property. He could hardly think people with a three years' tenancy would go to the expense, because the landlord might require them to put back the coal-range when they left. A gas-fire in a kitchen was, of course, very nice; but he wondered how Mr. Westbrook found consumers who were prepared to allow servants the use of a gas-fire in the kitchen. Most mistresses would be inclined to regard this as somewhat of a luxury. No doubt, if they did away with the coal-range, they must have some means of warming the kitchen; but it seemed that gas-fires would be rather extravagant for long-period consumption like that—from early morning to late at night. With reference to fig. 5, Mr. Westbrook said he had converted this installation to the cylinder system; but when they referred to conversion to the cylinder system, it generally meant a case where the storage tank had been brought down to the level of the boiler. He did not say the author's was not actually a cylinder system; but could he not have brought the tank downstairs, and saved the flow and return? Some of the consumptions mentioned in the paper, for the number of fires and other apparatus in use, appeared to be very light. There was one case with eleven gas-fires, where some gas might be expected to go through. He supposed the meters were all right.

The PRESIDENT remarked that the servant trouble certainly increased the importance of the subject under discussion. Mr. Westbrook's idea was to be commended; and he thought every one would agree that, as shown by the drawings, the installation looked well. Doubtless, also, it carried out all its functions to the full. The paper was not one that lent itself to a great amount of discussion. The author had put before them a simple statement of facts; and they were very grateful to him for the trouble he had taken in so doing.

Mr. F. AINSWORTH (Ilford) said reference was made in the paper to matters which were of particular interest to him. Mr. Westbrook, in connection with his gas installations, described a method of dealing with the ventilation at the top of the building; but he (the speaker) did not know whether this could always be a success. Possibly the building referred to was a low one; and, if so, would the author recommend the same course in the case of lofty premises? Could he not arrange for the ventilation to be dealt with lower down, by adopting a damper immediately above the apparatus, so that the draught could be regulated as required? This might save a certain amount of trouble which perhaps would otherwise arise. Again, did the author recommend a 35 gallon tank for hot water? His own experience was that the larger the storage, the less satisfactory it was. For an ordinary house, he thought 20 gallons was quite sufficient; and it would be much more economical. A friend of his had an idea that he would like to have plenty of hot water, and he went in for a 40-gallon system; but it cost him so much that he afterwards had it changed for a 20-gallon one. In connection with one of his installations, he (Mr. Ainsworth) had met with a difficulty which might have some bearing on the paper. The piping of a hot-water service had been renewed only twelve months previously; and yet the people could not get sufficient hot water. He saw the consumer, and suggested that he should have a circulator put in; and this was done by connecting it in the ordinary way to the inlet and outlet of the boiler. It appeared at the time to give satisfaction; but the consumer soon found that he did not get hot water quickly enough. An investigation was then made, and it was discovered that the pipe had got coated up. The iron pipe was therefore taken out and replaced by a lead one; and this proved a success. He remembered an instance of a large shop, where the pipes did not appear to be laid properly, so they arranged with the builder to relay them; and in another case the cold water was run too high into the tank. The paper dealt with a promising branch of business; and it would pay gas companies to put in these installations at very much less than cost, until people got to know the value of them. He fully expected the future of gas to be more prosperous than the past; and he believed they would be able to get these things to a more economical point than was possible at the present time. He had come across a case in his district, where the people had got an electric cooker free of cost

as far as the rent was concerned, and then they found it too dear to use.

Mr. WESTBROOK, in replying to the points raised, said that, of course, the ownership of the house was an important point in connection with obtaining an order for one of these installations. If the occupier was not the owner, he had to try and bring the landlord up to the scratch. In some cases where the tenants had been fairly well off, they had done the thing themselves. In other instances, tenants had brought their landlords along to the show-rooms, and there had been an arrangement as to sharing the costs. They had not really found much difficulty in this way; but, of course, the initial cost of the installation was one of the principal drawbacks. The cheaper gas undertakings could see their way to put them in, the greater would be the inducement to adopt them. In regard to the servants' fire, undoubtedly a gas-fire going all day was something of a luxury; but when a room was once properly warmed, it did not take much gas to keep it at a comfortable temperature. The fires were fitted with loose keys, so that the mistress could keep complete control of them; and, of course, it had to be remembered that during a great part of the day a servant was moving about at her work, and so did not require a fire. The cylinder system of water heating, he took it, meant where the draw came off the expansion-pipe. The reason they did not bring the tank down was that in this particular case there did not happen to be any convenient place in which to put it. Another thing was that one had to be very careful in moving these tanks down to a lower level. The builders put them in so light that very often they would not stand the extra pressure.

Mr. BROWN: Generally we leave the tank where it is, and put in a cylinder at the bottom.

Mr. WESTBROOK remarked that, in addition to the fact that, in the case referred to, there was not the chance of doing this, it would, of course, increase the expense. With regard to the consumptions shown, he explained that in one case the user was particularly careful. He thought that the consumption in the installation with eleven fires was a fairly reasonable one. There was an increase of 100,000 cubic feet, which was a good figure for a house of that size. Mr. Ainsworth had referred to possible difficulties in regulating ventilation at the top of the building. All the installations were fitted in ordinary villa residences. It was suggested that the matter might be dealt with by means of a damper down below; but in this case they would have to damper three flues, instead of one at the top. Any dampering there was should be done carefully. The excessive draught was due to everything being closed-in. As to preference for 20 or 30 gallons storage, cases had, of course, to be considered on their merits. For instance, one would not think of putting a 20-gallon system in with two baths. Where it was for 30 gallons, he recommended cutting-down for villa residences. He took it that, lead pipe having a smoother surface, the furring-up was not such an easy process as was the case with iron. Of course, the cold water was always kept as low as possible in its entrance to the tank.

Mr. C. TANNER, sen., who proposed a hearty vote of thanks to Mr. Westbrook for his paper, expressed regret that ill-health had prevented him lately from attending the meetings of the Association as frequently as he would have liked, and remarked that the same cause had compelled his retirement from the position of Works Superintendent at Gillingham.

Mr. AINSWORTH, in seconding, urged that the juniors would greatly benefit themselves by attending as many of the meetings as they possibly could, and taking part in the discussions.

Mr. WESTBROOK acknowledged the vote.

Gas Coke as Fuel.

Striking facts with regard to the economy of steam-driven motor waggons, with the use of graded gas coke as fuel, are contained in a handy-sized booklet on "The Fuel Problem" issued by the London Coke Committee. The figures quoted prove that wherever graded gas coke can be purchased at under 90 per cent. of the price of good quality Welsh coal, the former is the more economical fuel. This point being ascertained, the next step is to find out where this desirable fuel is to be obtained; and here, again, the booklet offers valuable aid, inasmuch as it contains a list of 200 supply depôts where graded gas coke is stocked for the convenience of steam-motor users. The list renders the booklet an exceedingly useful addition to the equipment of steam-motor drivers—which usefulness is further enhanced by some practical hints on firing gas coke. Free copies of the booklet are, it may be mentioned, available to steam users, on application to the London Coke Committee, at No. 84, Horseferry Road, Westminster. Drivers who may, when out, require a fresh supply of fuel, and have not the printed list of depôts handy, must look out for a green and white sign-plate bearing the words "Motor Coke," which indicates wayside supply depôts where graded gas coke is stocked for the convenience of steam-motor users. By the way, the London Coke Committee are also issuing a pamphlet on "Fuel Economy in Dyeing, Cleaning, and Laundry Work." For these purposes, gas coke is a highly desirable (because it ensures smokeless combustion, which is so necessary in these industries), as well as an economical, method of raising steam.

A paper, entitled "Notes on the Ignition of Explosive Gas Mixtures by Electric Sparks," will be read by Mr. J. D. Morgan to-morrow (Wednesday) evening at Birmingham before the local section of the Institution of Electrical Engineers.

SCOTTISH JUNIOR GAS ASSOCIATION.

(WESTERN DISTRICT.)

The second meeting of the curtailed session of the Scottish Junior Gas Association (Western District) was held in the Royal Technical College, Glasgow, last Saturday—the PRESIDENT (Mr. David Fulton) in the chair.

The INTERIM HON. SECRETARY (Mr. Malcolm Littlejohn) intimated that Mr. W. M. Mason, the Secretary of the British Commercial Gas Association, had forwarded a complete set of the literature published by his Association for the use of members.

A LOSS TO THE ASSOCIATION.

The PRESIDENT referred to the great loss the Association had sustained in the death of Lieut.-Colonel Henry O'Connor. There was hardly a member of the Association who had not gone through his classes in that college, and had greatly benefited thereby. It was agreed to send a letter of condolence to the widow.

Mr. E. STROUD, of the Holophane Company, read a paper, illustrated by lantern slides, on

MODERN ILLUMINATION AS APPLIED TO GAS LIGHTING.

The author began by referring to the recent report of the Departmental Committee on Lighting in Factories and Workshops, some of the recommendations contained in which he quoted; and then he proceeded to discuss the means by which these recommendations could be carried out. He remarked that a statistical inquiry into the number of accidents during each month throughout the year points to the conclusion that inadequate lighting is a contributory cause of accidents. Complaints of eye strain, headache, &c., attributed to insufficient lighting, are common; and there is a general impression that unsatisfactory lighting is, in various ways, prejudicial to health. It is also recognized that insufficient light adds to the difficulty of the proper supervision of work and of the maintenance of cleanliness and sanitary conditions generally.

With reference to the recommendations as to the minimum intensity of illumination required for safety, he said it had been pointed out that this was an absolute minimum permissible in the darkest places, and that the illumination at most other parts would be very much higher. At the same time, he would suggest that the most important consideration was the contrast of illumination, and that a ratio should be fixed maximum to minimum in any one shop. It would easily be seen that a man working on his lathe with a local light giving (say) 20 foot-candles on the machine, and looking or moving away to the relative obscurity of 0·5 foot-candle illumination, was liable to stumble and fall over any obstruction which might be in the way. With the present high-power sources and modern methods of distribution, it is possible to get an extremely even and efficient illumination at very small cost; and he thought that a general illumination of 1 to 1·5 foot-candles should be allowed for, besides local lighting. He would also suggest that, in addition to the periodic cleaning of windows for natural lighting, a periodic cleaning of the lighting units should be enforced, as it was quite possible to get a considerable reduction in illumination after the units had been installed some time, by excessive dirt on burner or reflector.

Continuing, Mr. Stroud said it would be noticed that in the Committee's report all numerical recommendations are made in terms of foot-candle values; the foot-candle being the unit of intensity of illumination as distinct from the candle power of the source, the candle power being the unit of intensity of light.

Light is the cause, illumination is the effect. Bearing this in mind, it will be seen that, before it is possible to make an installation with any degree of certainty of result, one must know the performance of the unit proposed. There is, of course, the cut-and-dried method of installation, experience, and also the allowance of excessive candle power—all of which fail in the essentials of adequacy, economy, and certainty of which installations can be made with predetermined and fixed illumination values necessary for different classes of service.

By using different types of reflectors, any form of distribution can be obtained, varying from concentrating to extremely extensive. It is certain that very poor results could be obtained by using an incorrect distribution for a specific purpose; and it is equally certain that tremendous advantage and economy are to be effected by being able to alter at will the distribution of the bare source to suit any particular problem.

The distribution or polar curve is the graphic representation of the light distribution. The intensity of light is taken for various angles in a vertical plane through the lamp axis, and plotted in terms of candle power, conveying a clear idea of the manner in which the light is emitted. These curves really represent solid angles or cones of light. It is a popular fallacy that the area included by the vertical distribution curve is a measure of the total flux emitted by the source. This is entirely erroneous, as, of course, the curve of the reflectors (which are greater in area than the bare source), cannot, of necessity, have a greater quantity of flux of light than the original source. In fact, in every case, the total flux in the reflector combinations is less than the bare source by the absorption of the reflector. I have a slide which shows three possible vertical distributions, each representing the same flux of light; and to make this important point more clear, the

next slide shows a simple illustration of a ball which has a white disc on the bottom which represents a 10° zone in a vertical plane, and a number of white discs of the same diameter around the circumference, the whole of which represents a 10° zone in the horizontal plane.

This flux of illumination, which is measured in lumens, is equal to the intensity of illumination (foot-candles) multiplied by the area over which it is distributed. Therefore, a source of 1-candle power illuminating an area of 1 square foot with 1 foot-candle intensity would be equal to one lumen. Similarly, a source of 1-candle power intensity in all directions placed in the centre of a hollow sphere of 1 foot radius would illuminate the inner surface with an intensity of 1 foot-candle, giving a total lumens of 12·56, since the area of a sphere is found by multiplying the square of the radius by the constant 4π (12·56).

To calculate the mean spherical or mean hemispherical candle power from the distribution curve, it is required to know the total lumens emitted either in the whole sphere or hemisphere under consideration, and divide by 4π (12·56), or 2π (6·28) respectively; and to find the total lumens emitted it is required to take the average candle powers of the different zones and multiply by what are called the "zone factors." It is usually convenient to figure for zones of 10°, and sufficiently accurate to assume that the candle power at the centre of each 10° zone represents the average candle power of the zone.

The following are the factors which such candle power values should be multiplied by to give the lumens in each 10° zone.

Zone.	Factor to Obtain Lumens from Average Candle Power.	Zone.	Factor to Obtain Lumens from Average Candle Power.
0 to 10 ..	0·0954	50 ,, 60 ..	0·897
10 ,, 20 ..	0·283	60 ,, 70 ..	0·992
20 ,, 30 ..	0·463	70 ,, 80 ..	1·058
30 ,, 40 ..	0·628	80 ,, 90 ..	1·091
40 ,, 50 ..	0·774		

Above 90° the factors are the same, but of the reverse order.

To use these factors with the curve of any light unit, take the candle power at 5° and multiply by the 0° to 10° factor to obtain lumens in the 0° to 10° zone; take the candle power at 15° and multiply it by the 10° to 20° factor, &c. The total lumens for any large zone is the sum of the lumens thus determined. The total of the factors 0° to 180° being equal to 4π (12·56) the area of a sphere.

The reason will be seen why it is possible to obtain an extreme concentrating reflector to give an end-on candle power many times the rated horizontal candle power of the source. As with (say) 1000-candle power over the 10° vertical zone gives $1000 \times 0{\cdot}1 = 100$ lumens; but with only 100-candle power in the horizontal 10° zone, we get approximately the same quantity—viz., $100 \times 1{\cdot}1 = 110$ lumens.

Every lighting unit should have such a curve supplied with it, which would show the engineer the distribution he would get, and whether such a distribution is the most suitable, and also enable him to calculate the height to place the units, and the distance apart, to obtain even distribution (if required), after having decided the foot-candle intensity that is necessary for the particular problem in hand.

There is a slide which shows a distribution curve coupled with the illumination curve. It illustrates the method of calculating the illumination curve, and also the formula necessary. But I do not propose at this stage to deal fully with illumination curves, spacing of units, &c. The plan adopted in this case is called the point-by-point method; and neglecting the reflection from surroundings, the resultant illumination can be determined with considerable accuracy. In practical problems, the "effect of surrounding" is important as to the resultant illumination obtained. Naturally, reflection conditions vary widely in practice; and it is impossible to give values which are of universal application. Should the reflector be opaque, no light will reach the upper hemisphere, and therefore no reflection will be obtained from the ceiling and upper portion of walls.

With "Holophane" reflectors an increase in the actual illumination over that calculated by the point-by-point method is as follows.

Condition Ceiling.	Condition of Walls.	Per Cent. Increase over Calculated Illumination.
Very dark	Very dark	0
Medium	Very dark	15
Medium	Medium	40
Very light	Very dark	30
Very light	Medium	55
Very light	Very light	80

In conclusion, Mr. Stroud drew attention to the "Lumeter," and threw on the screen some slides of recent examples of gas lighting.

DISCUSSION.

Mr. John Colquhoun (Glasgow) asked if the lumeter was an accurate instrument. If it was not accurate, what degree of inaccuracy must one allow for it? He was interested to see that the photometer which Mr. Stroud put on the screen entailed an arrangement of mirrors. What allowance was made for the absorption of light by the mirrors? And what about dust? The table giving the percentages of reflection from wall surfaces ought to be printed broadcast, and given to painters and decorators. This matter of reflection was one greatly neglected in houses, churches, and other buildings.

Mr. J. M'Ghie (Glasgow) said if he was not mistaken, Mr. Stroud's Company set out to get the maximum amount of light on the object, not on the eye. He believed this was one of the claims of the Holophane light. He had been using Holophane glassware for some time. He had, however, fitted up an office frequented by gas men with the extensive Holophane shade. But the men preferred to go back to the full, clear globe—chiefly because they had not become accustomed to the benefits of the diffused light. He discovered that the principal objection, however, was the greater quantity of dust that collected about the Holophane prisms and corrugations as compared with that which collected on the ordinary globe. This was a matter, of course, of keeping the shades in order. The second question was one of expense. Unfortunately, though the ordinary consumer seemed to spend money like water on certain things, he would not go to the expense of Holophane shades. The new glass shades that were coming from America were going to be a serious rival. Personally, he believed in semi-indirect lighting. He was consulted a few years ago about the lighting of a large drawing office, which eventually went in for indirect lighting. He was sure, however, that if they were reconsidering the matter they would instal semi-indirect lighting. He had never experienced the slightest eye-fatigue from semi-indirect lighting. Dealing with the Home Office Committee's findings, to which Mr. Stroud alluded, he thought it a waste of labour to set up any laws regarding the lighting of workshops and factories. If a scheme of standardization or of issuing a certificate by a national laboratory regarding the types of lamp were adopted, it would help the work of the engineer. It would be quite a simple matter for him to fix his lighting on the principle of going on a basis varying according to the need of the work from (say) 0·50 candle up to as high as 2 candles per square foot of floor surface. All these systems had to be used with a very large amount of common sense. A man might have the tables at his finger ends; but unless he used common sense he might as well throw them away. With regard to shop lighting, one could see a shop artistically lighted, but the whole effect was spoiled by a neighbour putting up arc lamps. If there was a law to prevent building that destroyed another's site, why should not the same apply in the matter of lighting? No large power lamp should be allowed outside a shop without an adequate shade on the street side of the lamp. This was a thing that ought to be insisted upon by the law authorities all over the country.

Mr. John Wilson (Falkirk) was not quite clear about the remark made by Mr. Stroud on the ratio of maximum and minimum illumination. Did he mean thereby to eliminate the bad effect of contrast? He had had an experience two years ago in a works well lit with regard to the working parts, while the passages were lit on the standard required by the Factory Act. But, owing to the contrast, the latter appeared dark. Accidents had happened in this way. Was there anything in the scheme the Departmental Committee had put forward which would eliminate this? It was possible to get 25 per cent. better lighting by keeping globes clean. The "Lumeter" was worked by an accumulator. He took it that the instrument should be standardized before going out to make tests. Was it necessary to standardize it when one came back, and make allowance because of loss of voltage in the accumulator? Personally, he did not see how the accumulator could give constant voltage. There might be much in this. One forgot that illumination was a different thing from light. It was only lectures such as they had had that night which freshened them up and made them think about these things a little more clearly.

Mr. Malcolm Littlejohn said Mr. Stroud had dealt with what was generally accepted as correct. He was glad to see he had emphasized the matter of contrast. One could not be too particular about contrast. They had had examples in the streets where too brilliant a light meant that one seemed afterwards to be going into darkness. The same effect was experienced in a dark road after meeting the bright head-lights of a motor-car. He was not much in favour of dealing in lumens. The calculation of illumination on the horizontal plane was quite complicated enough without dealing with the question of lumens. The polar graff was quite sufficient for all practical purposes. Now that, with gas sources, the candle power in each direction was the same, there was no necessity to get lumens and complicate the calculations.

The President, in calling on Mr. Stroud to reply, said that the science of illumination had been neglected by gas engineers. They were only now beginning to realize that it was a science. Perhaps the best thing of which they could assure Mr. Stroud was that he had increased their knowledge. It was to be regretted that the price of glassware was so high.

Mr. Stroud admitted, in reference to the use of the photometer that there was absorption due to the mirrors; but in the ordinary tests it was more a matter of comparison—one lamp with another. They knew, however, the absorption due to these mirrors when clean, and could calculate accordingly. He also thought there should be some standardized rating of lamps, and that there should be certain provision made with people to rate their lamps, whether in lumens or not. If one lamp was so many lumens and another so many lumens, one could compare. Other than this there was no real way to compare. One maker boasted of 1000-candle

power, and another gave the power of his lamp as 100-candle power; and perhaps the latter was giving the greater quantity of light. Regarding the lumeter, provided it was charged properly, it was accurate within 5 per cent. Usually the instrument was used for comparative tests; and there it was correct always. In reference to Holophane shades and the question of dust—it was an old sore. People said they had a large surface area and held dust; but, at the same time, Holophane reflectors suffered less difference with dust than ordinary shades. Dry dust did not affect the prism at all. The trouble was when they got sticky dust on the reflectors; then it killed the prisms right away. It was very true about the effect of a film of dust on a globe. It was possible through this means to lose 30 per cent. If people understood the relation of light to the painting of rooms it would aid them greatly. They had a table giving the increases with certain kinds of paint. It was interesting to see the increases due to white surroundings. The matter of contrast was extremely important; it had not been realized. A very good illumination could be spoiled by having excessive contrast. If one had a certain maximum, then one must have a certain rate between that and the minimum. Contrast increased the liability to accident.

NEW SOUTH WALES AND QUEENSLAND GAS INSTITUTE.

First Annual Meeting.

In the rooms of the Royal Society, Sydney (N.S.W.), on Tuesday, Oct. 26, there was held the first annual general meeting of the New South Wales and Queensland Gas Institute, under the presidency of Mr. T. O. MORLAND, the Manager of the North Shore (Sydney) Gas Company.

The first annual report of the Council (which was signed by the President and Mr. H. Tindale, the Hon. Secretary) stated that the number of members on the roll was 46. Mr. R. J. Lukey, the Secretary of the Australian Gaslight Company, Sydney, was elected President for the ensuing year, and Mr. Andrew Wilson Vice-President.

After the delegates had been cordially welcomed to the city by the Lord Mayor, Mr. Bragg (the President of the Engineering Institute of New South Wales) said that old-established Society welcomed the new body into the circle of kindred associations. It was proposed to establish a library of engineering works in the Royal Society's house. The Gas Institute and all similar associations would be invited to contribute towards this library.

In the course of his Presidential Address, Mr. Morland said that during the last six months gas companies had been considerably harassed by constant labour troubles. Managers should take upon themselves the duty of making provisions which would mitigate the inconvenience of labour disturbances. He discussed at considerable length a large variety of labour-saving devices and methods for the production of gas, and remarked that recurring troubles in the coal industry could be largely mitigated by keeping surplus stocks of coal at the works. His experience at North Shore had led him to believe that coal could be stacked in the open air without any appreciable reduction of its gas-producing capacity. The gas industry was not decadent. In New South Wales, between 1907 and 1914, the number of gas-works had increased from 35 to 45. Of the latter number, 23 were owned by companies, 21 by municipalities, and one by the Government. The output of gas had increased during the same period from 2,777,936,000 to 4,674,850,000 cubic feet, and the number of consumers from 100,542 to 152,872. In Queensland, in the same period, the number of gas companies had only increased by one; but the output of gas had increased from 372,058,000 cubic feet to 745,535,000 cubic feet, and the number of consumers from 13,427 to 27,564. The cost of the production and distribution of gas in the same time had increased by 50 per cent. As to competition with electricity, his Company were soon to be faced with this problem in the four municipalities on the north side of the harbour. He did not, however, anticipate that this competition would materially decrease the volume of his Company's business. They had taken steps to combat it. Electricity had its disadvantages. It had been shown that as an illuminant it cost twice as much as gas, while as a heater it cost over three times as much. The industrial laws pressed very heavily upon most employers of labour. On gas-works they pressed more heavily than upon most. Gas-works could not close-down their businesses at a time of industrial disturbance without inflicting great inconvenience upon the general public. Industrial agreements might be entered into, and wages boards might determine by awards the amount of wages to be paid; but neither of these appeared to be sufficient. As soon as ever the workmen thought they should get more wages they made a demand; and if this was not granted, there came a threat at once to down-tools. The position had become so acute that, in a works employing (say) 1000 men, there was almost enough work now to keep one officer fully going in attending wages boards and conferences with union secretaries. Surely Parliament could impose conditions which would ensure the protection which the public so much needed. This consideration must force itself upon the attention of their legislators in the very near future.

After luncheon, three papers were read and discussed—"High-Pressure Gas Distribution," by Mr. T. F. Waugh; "Experiences in Country Gas-Works in Queensland," by Mr. D. A. Campbell; and "Experiences in the Working of Vertical Retorts," by Mr. J. Mackenzie. There was also a "Question Box" discussion on the programme.

On the following day, a much enjoyed visit was paid to the works of the Australian Gaslight Company, the North Shore Gas Company, and the Manly Gas Company.

MUNICIPAL WORKS IN REINFORCED CONCRETE.

There has already appeared in the "JOURNAL" an extract, dealing with county councils as water authorities, from the Presidential Address of Mr. Henry C. Adams to the Institution of Municipal Engineers; and this may now be supplemented by another portion of the address, in which Mr. Adams referred to the use of reinforced concrete in municipal work.

With the exception of small highway bridges, comparatively little progress has been made in the application of reinforced concrete to municipal works. One factor is, no doubt, that much of the work to which it might be applied is small in character and in positions difficult of access or remote from centres of population. To ensure satisfactory results, it is essential that the whole of the work should be constructed by skilled labour under the direction of men with an extensive experience in such work. As these are not generally available in every district, the cost of the work would necessarily be high. Another, and perhaps the chief, reason is the extremely short period which the Local Government Board will allow for the repayment of loans for work done in this material. It would appear that in this respect the Board have departed from their now usual practice of fixing the loan period co-determinate with the probable useful life of the projected work or the average life of work of a similar character. It is well known that the actual life from numerous practical examples has already greatly exceeded the loan periods allowed; and it is surmised upon good and substantial evidence that its life is unlimited. Consider the two materials—concrete and steel. The concrete grows stronger the older it gets; and the steel, when properly embedded, is imperishable. When a structure is once loaded to its full extent without failure, little fear need be felt as to its future, provided, of course, that the steel is not stressed beyond the elastic limit. If this is done, it will stretch, and the concrete on the tension side will crack, and that on the compression side may spall, with the result that moisture will penetrate to the steel, causing rust and eventually leading to failure. The workmanship is most important; and the concrete must be dense in order that it may satisfactorily protect the steel.

Reinforced concrete, in common with some other branches of structural engineering, is to a great extent in the hands of individuals and firms interested in a particular form of construction, or, to adopt their own title, "specialist firms." In small steel-work structures—such as simple roof trusses, portable iron buildings, &c.—it is common for the manufacturers to design the work and afterwards supply the materials or the completed structure. In reinforced concrete, it is more usual for a "specialist firm" to design the work, which is subsequently carried out by a "licensed" contractor. The design of reinforced concrete is based on well-known fundamental principles of mechanics, although practical experience shows that it is desirable to make certain allowances which are not necessary under other circumstances. No doubt in the future every civil engineer will acquire knowledge in this branch as a matter of course, in the same way that he now studies brickwork. But at present such knowledge is not general; and, apart from the "specialist firms," there are only a limited number of independent engineers who are qualified and competent to design such work, or to verify the calculations relating thereto. The latter men are, however, now sufficiently numerous to cope with the amount of work to be done, only their natural modesty—to say nothing of professional etiquette—prevents their existence being so well advertised as that of the "specialist firms." The result is that the bulk of the work is in the hands of such firms; and the usual practice is for general designs or sketch plans to be sent to half-dozen of them, who each spend valuable time and money in preparing detail designs and tenders for the work.

The work of some of these firms may be above criticism; but there are others who betray lamentable ignorance or carelessness. All schemes, however, with a view to cheapening the cost, are naturally based on the minimum requirements; and the margin for contingencies in workmanship and materials is of necessity small. It must not be supposed that the client reaps the whole of this advantage of competition, because the cost of preparing the design, and not only the accepted design, but many others for other clients which have not been accepted, must be charged in the tender. I am informed that in a case recently heard in the Courts it was given in evidence that it was the custom of the "specialist firm" concerned to charge 10 per cent. upon the cost so as to cover designing charges. It would be advantageous if these and similar items were set out separately in tenders, as it would be efficacious in demonstrating to the public who employ engineers in a professional capacity that the money paid direct to them by way of salary or fees is far from being unreasonable having regard to the services rendered.

After designs have been obtained in the way described, and one

has been selected for construction, the Local Government Board sometimes require that it shall be subjected to an independent opinion before a loan will be sanctioned; and this, of course, means further expense in fees. There is no reason at all why reinforced concrete work should be treated differently from (say) sewage-works or water-works. It might well be argued that it is like buying a single article. But, even so, the interests of the client demand the preparation of a detailed specification, and subsequently the exercise of sufficient skill and experience to see that the conditions of the specification are fulfilled in the design and in the construction.

The reinforcement of concrete for road beds by means of a network of strong steel wire presents several points of interest. Some of the members may have noticed from the technical papers that a High Court action was recently brought by the Gas Light and Coke Company to restrain the Woodford and Wanstead Urban District Councils from using wire-fabric road reinforcement, on the ground that its employment would be a hindrance to the Company in getting down to their mains. Experimental lengths were constructed by the Gas Company of reinforced concrete 6 inches thick and ordinary concrete 12 inches thick, upon which, at a later date, workmen were put to open through. It was found that the reinforced concrete was cut through in a shorter time than the thick bed of ordinary concrete; and the Gas Company thereupon withdrew the action.*

NATURAL GAS FOR WELDING AND CUTTING.

According to an author (Mr. J. F. Springer) writing in the American "Railway Age Gazette" for October, while ordinary natural gas consists largely of methane, the heating value of which is low in comparison with acetylene, there is at Follansbee, West Virginia, a natural gas produced which contains no methane and is made up of approximately four-fifths propane and one-fifth ethane—a gas with a thermal value of 2468 B.Th.U. per cubic foot. Experiments with the gas at various stages of compression indicate that the constituents of higher thermal value are first liquefied, leaving the others in the residual gas. When subjected to 400 lbs. pressure per square inch at 32° Fahr., and revaporized, a gas of varying quality was obtained. Of several samples taken at regular intervals, one was almost pure ethane, another almost pure propane. The lowest thermal value was 1808 B.Th.U., and the highest 2621 B.Th.U. per cubic foot. The methane which has the lowest heating value (1065 B.Th.U.), and so is the least desirable in the semi-liquid product, needs a pressure of 2700 lbs. per square inch to cause it to liquefy, and is therefore not apt to be present in the products of compression under 400 lbs. per square inch.

From another set of experiments with Follansbee gas under 400 lbs. pressure, it was found that samples drawn from the top of the same cylinder varied considerably in quality and heating value. It was found, however, that by drawing the supply for the torch from the bottom, a gas of approximately uniform quality may be obtained. Its boiling-point is −40° Fahr.; and at 32° Fahr. it requires a pressure of 400 lbs. to maintain it in a liquid state. At 131° the pressure is 755 lbs., which is well within the practice of handling similar products. If higher temperatures are apt to be met, it will not be difficult to secure containers to withstand the higher pressure.

The new gas seems to have originated through the development of natural gas gasoline, which was first obtained by simply collecting the liquid formed by condensation in pipes transmitting natural gas. The next step was artificial chilling of the pipes, followed by low-pressure, single-stage compression, and later of carrying the raw gas through two stages of compression.

INDUSTRIAL USES OF TAR OILS.

THE enhanced importance for industrial purposes which the constituents of tar oils have attained in the course of the present war has prompted our contemporary, the "Journal des Usines à Gaz," to publish a series of articles by Professor Mailhe, of Toulouse, in which are passed under review the bodies occurring in tar oils—particularly in respect to their use in the manufacture of explosives and drugs, and with regard to the methods that gas makers should follow for their recovery. The full text of these papers would not repay translation, since much of the matter is familiar to those in this country who have made a study of residuals; but an abstract of portions of M. Mailhe's contribution may be made—particularly of those which deal with the properties of certain aromatic hydrocarbons in tar, the industrial value of which has not hitherto been sufficiently realized.

In the light oils distilling from tar at temperatures from 175° to 280° Fahr., the most important hydrocarbon next to benzene is toluene, present in quantity about one-third that of benzene. An average yield of toluene is 1 litre per tonne of coal. Xylenes and ethyl-benzene and the paraffin hydrocarbons of the cymene groups likewise come over at these temperatures, but in far smaller quantities—benzene and toluene being the two raw materials from tar for the making of explosives, dyes, and other chemical preparations. While benzene is of secondary importance as a material for explosives, by conversion into picric acid [melinite], toluene in its tri-nitrated form of "T.N.T." or "Tolite" is sought after for its many valuable properties in artillery.

M. Mailhe places the French pre-war production of crude "benzol" (benzene, toluene, &c.) from all sources at 5200 tonnes, which includes that obtained by coke-ovens. He dismisses the synthetic conversion of benzene into toluene as being commercially impracticable. Efforts to increase production may be made in the direction of the removal of toluene from (1) coal gas, and (2) light petroleum oil. The former source—though attractive at first sight—is one which will be drawn upon with much caution, owing to the large plant required for washing gas with the extractive tar and for the subsequent distillation of the hydrocarbons from it.

In the case of petroleum oil, only that is of value which yields distillates containing aromatic hydrocarbons. Borneo oil is an important source, which Germany has long utilized for the production of benzene, toluene, xylenes, &c. One works at Rotterdam treats several tonnes per day of Borneo distillate containing from 15 to 20 per cent. of aromatic hydrocarbons and representing not 1 per cent. of the crude oil. Benzene, toluene, xylenes, and cumenes are obtained by repeated rectification; but the laborious process is not successful in yielding pure products—the toluene always containing some 30 to 40 per cent. of paraffin hydrocarbons, though still utilizable for the manufacture of explosives by first converting into the mono-nitro compound, distilling off the fatty hydrocarbons in steam, and then carrying the nitration to the di- and tri- stage.

As regards substances of the phenol and cresol groups present in tar to the extent of 12 to 15 per cent., only the tri-nitro derivations are of importance as explosives; tri-nitro phenol [picric acid] being the explosive body most largely used, and normally produced from phenol recovered from tar. The French authothorities have, however, been successful in organizing the manufacture of picric acid from benzol by synthetic processes.

The use of the cresols presents difficulties as regards the formation of tri-nitro compounds in the case of para- and ortho- cresol, though the explosive, "Ecrasite," which is used in Austria, is of this origin.

Naphthalene, forming 50 to 60 per cent., of the medium tar oils, is readily nitrated—forming explosives which require admixture with an oxidizing salt for their full effect. Dinitro naphthalene and ammonium or sodium nitrate is the admixture most usually employed. It forms the basis of the Favier series of explosive powders—possessing many notable advantages, and more recently used by Schneider's firm for filling shells. Naphthalene is, in fact, a plentiful and valuable raw material; and M. Mailhe lays special emphasis on the importance to gas makers of methods for the recovery in future of both naphthalene and phenol as saleable products.

In his reference to pharmaceutical compounds derived from tar, M. Mailhe does little more than quote a recent report by M. Ernest Fourneau, the Director of the Laboratory of Therapeutic Chemistry, to the "Société d'Encouragement pour l'Industrie Nationale," in which he takes his countrymen to task for their timidity in allowing Germany to gain possession of the manufacture of organic medicinal substances, while at the start they [the French] had the advantage of their supremacy in the supply of medicaments of inorganic origin. He reproduces a schematic synopsis from M. Fourneau's paper showing the numerous Teutonic products prepared from the raw materials in gas tar.

Marriage of Mr. Bloor.

On Saturday, at St. Philip and St. James' Church, Clifton, York, by Rev. C. T. Alexander, M.A., Harold Edgar, eldest son of Mr. Henry Bloor, J.P., of Garswood, Hoylake, was married to Alice Maud, only daughter of Mr. William Bellerby, of Clifton, York. The bridegroom is the Secretary and Manager of the York Gas Company.

Gas-Works Directory and Statistics for 1915-16.

Once more the work has been undertaken by Messrs. Hazell, Watson, and Viney, Limited, No. 52, Long Acre, W.C., of bringing up to date—or as nearly so as is possible, for even while the book is in the press further official and other changes are, of course, taking place—their well-known "Gas-Works Directory and Statistics." The issue for 1915-16—the thirty-eighth of the series—is now ready; and the statistics contained in it have been revised to August last. The book has been prepared on the same lines as hitherto; and those who consult it will accept the assurance given by the Editor that every effort has been made to obtain the latest available information—the source being the managers, engineers, and secretaries of the various gas undertakings. These are times of changes in gas prices; and it is pointed out that in cases where rates of charge have been altered since the date of the receipt of official figures, a separate line has been inserted, with the amount of the increase. In addition to the full information given with regard to the different undertakings, there is an alphabetical index of gas-works officials, and a list of Senior and Junior Associations of Gas Engineers and Managers throughout the country, with the names in each case of the President and Secretary. The price of the directory, it may be mentioned, is 10s. 6d. net.

* See "JOURNAL," Vol. CXXX., p. 764.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Who was the Originator of the Sliding-Scale?

SIR,—Let me see if I can trace the source of the sliding-scale to a more remote date than any yet reached by your correspondents?

Many years ago the late Mr. B. Leigh Smith (a Director of the Gas Light and Coke Company) gave me a copy of a paper he had written, and had had printed and circulated, in which he made the following suggestions:

1. That gas can be supplied more cheaply by a company having a district to itself than when it has to divide the lighting, and consequently the profits, with another company.
2. That a company would supply gas as cheaply as possible if it were its interest to do so.
3. That it would be the interest of a company to supply gas as cheaply as possible if, by Act of Parliament, the dividend were made to vary with the price of gas, so that the lower the price charged for gas the higher should be the dividend allowed to be paid.

Mr. Leigh Smith informed me that he wrote this paper "about the year 1860;" and, seeing that the London gas companies were actually districted by the Metropolis Gas Act, 1860, his first suggestion affords internal evidence that it was written not later than the parliamentary session of that year.

H. D. ELLIS.

Dec. 10, 1915.

Pooling of Coal Waggons.

SIR,—I desire to draw attention to an important proposal by the Board of Trade, to pool all railway-owned and private owners' coal waggons, as I am of opinion, if the latter project be carried out, it will prove prejudicial to many large users obtaining adequate supplies of coal, which in certain industries is of primary importance.

To the pooling by railway companies of their own waggons, traders can raise no objection; but it is very doubtful whether the pooling of private-owned waggons would, in actual practice, realize the benefits it may seem to offer in theory. And there are many objections to this waggon-pooling project, irrespective of their ownership.

The effect of this would be that those who have exercised sufficient forethought, and incurred the expense of providing their own waggons, would lose control of them. It means that they would be unable to allocate sufficient waggons to any particular contract, with the almost certain result in many instances of a shortage in deliveries. It is the common experience in times of difficulty and stress, that those who have not their own waggons find much greater difficulties in obtaining regular supplies than those who are in a position to ear-mark waggons specially labelled to run to and from particular points, and to which they must be delivered and nowhere else.

The provision of their own waggons for "Class A" traffic by many gas undertakings, colliery proprietors, coal factors, and other large coal-users has to a large extent saved the situation. But now it would appear that they are to be penalized because there is a shortage of railway-owned waggons for mineral traffic.

The relative tonnage carried by private owners' waggons is greater than by railway-owned waggons, because in the former case they are under more strict supervision than is possible by the railway companies—no doubt in some respects, owing to the fact that what is common to all is nobody's particular business. It is well known how waggons are often unreasonably delayed, in consequence of inattention on the part of those responsible, congestion of traffic, and using them for storage purposes.

I hope the gas industry will enter an emphatic protest against this proposal, which instead of facilitating deliveries of coal, is much more likely to very seriously jeopardize supplies all round, and lead to further chaos. Any interferences with coal supplies to so important a national industry as the supply of town's gas, would be a serious matter to the country at large—especially at the present time.

I suggest that all gas undertakings interested should immediately write a letter of protest to the Secretary, Railway Department, Board of Trade, Whitehall, S.W.

J. FERGUSON BELL.

Derby, Dec. 11, 1915.

Tar for Retort-Setting Heating.

SIR,—With the present low value of tar and pitch, and the comparatively high prices now ruling for coke, it has occurred to me that gas-retorts can with advantage be heated by means of dehydrated tar or pitch.

This applies more particularly to gas-works which have a tar dehydrating plant installed. If the tar is treated to dispel the light oils in conformity with the War Office regulations, I think there is a very good case for heating the retorts economically, and allow a considerable quantity of coke to be placed on the market.

If any of your readers have experience in burning solid or semi-solid pitch, it would be interesting to hear their views.

ALPHA.

Dec. 6, 1915.

Circulars of Inquiry.

SIR,—In the spring of this year I called your attention to a very bad case of the inquiry circular nuisance in connection with a northern gas-works, with reference to street lighting. An even worse case is that which recently came to hand from the Margate Borough Surveyor, and from what I have heard these inquiry forms have been sent broadcast throughout the country.

In these strenuous times, with the shortage of assistance prevailing, the waste-paper basket is the most suitable receptacle for documents of this description; but as the writer from Margate went beyond the limits of an ordinary inquiry, and asked for professional advice free, and other information of an entirely technical nature, I thought fit to reply to his questions in such a way as to compel him to realize that the brains of the gas industry cannot be sucked free of charge.

It may also be recalled that in May, 1907, inquiries were sent broadcast from the same individual with a view to acquiring information on the art of sulphate maanufacture, about which some caustic remarks were made at the time.

I think it would be as well if the gas industry left any inquiries from Margate strictly alone, as the Corporation do not own the gas-works there. The information is no doubt called for with a view to harrowing the Isle of Thanet Gas Company; and at the present time one can hardly care to assist in doing that.

NORTHERN GAS.

Dec. 7, 1915.

Naphthalene Troubles.

SIR,—As many gas undertakings are suffering from an abnormal number of naphthalene stoppages, consequent upon the extraction of toluol and benzol vapours from the gas, and as in some cases advantage is being taken of this by our competitors, who do not explain the cause to the consumer, it has been thought that it might be useful to managers to have an official explanation of the circumstances to send to any consumer who has suffered serious or repeated inconvenience from this cause.

I enclose a copy of the circular that has been prepared, and should be pleased to supply any number required at 6s. per 1000.

W. M. MASON, Secretary,
British Commercial Gas Association.

47, *Victoria St., S.W., Dec.* 13, 1915.

P.S.—It had been suggested that information on the lines of the circular should be issued to the public Press; but after most careful consideration, the Committee agreed that the best interests of the industry would be served by the matter being dealt with locally, instead of nationally.

[ENCLOSURE.]

THE GAS INDUSTRY AND THE WAR.

Temporary Inconvenience to Consumers caused by the Extraction of Raw Material for High Explosives from Gas.

The attention of gas consumers is directed to the following facts:

1. The country is dependent for the high explosives required in ever-increasing quantities by the armies and navies of the Allies upon the supply of toluol and benzol.

2. The main sources of supply of toluol and benzol are the gas-works, and the quantity of these materials that can be supplied to the Government depends strictly upon the quantity of gas supplied to the public.

3. The extraction of these vapours from the gas, by a costly and unremunerative process, while it does not appreciably affect the value of the gas to the consumer, does affect its capacity for retaining certain constituents (such as naphthalene) in gaseous form. These constituents are consequently more liable to solidify and deposit in the pipes carrying gas to the consumer. This is causing some inconvenience to the public, as well as hindering and making more costly the normal work of gas undertakings.

4. Steps are being taken as rapidly as possible with a view to counteracting this trouble, by special means that will not interfere with the supply of toluol and benzol to the Government.

5. Those of the public who may suffer temporary inconvenience from this cause are therefore asked to remember that the trouble is occasioned by the imperative necessity of providing the Government with the raw material for high explosives, that it is quite of a temporary nature, and that the continued and increased use of gas is at the present time of vital importance to the nation, and has a direct bearing upon the speedy armament and early victory of our forces.

W. M. MASON, Secretary,
British Commercial Gas Association.

N.B.—Should any consumer experience any shortage of gas supply, he is requested to communicate immediately with the gas-works or office, so that the trouble may be speedily rectified.

Loughborough Gas-Works Profits.—It was remarked by Mr. Toone, at a meeting of the Loughborough Town Council last week, that the Gas Committee's balance-sheet for the past half year showed an excellent six months' trading. The profit made was £2855, against £2066 in the corresponding half year. The result reflected credit on the works; and though they could not say they were out of the wood yet, and could not anticipate the future at such a time, yet they had done very well. It might be of interest to state that the ordinary consumers had maintained their numbers—2140, against 2139; while the slot consumers had gone up from 3430 to 3570, and cookers from 733 to 757. The gas consumed showed a small increase of 138,000 cubic feet, or 0·24 per cent.

Government Claims a Council's Water-Pipes.—At a recent meeting of the Nantwich District Council (according to the "Ironmonger"), discussion took place over correspondence with the contractors for the supply of pipes for the Audlem Water-Works, whose account to date was £6268. The Local Government Board had asked for particulars of the contract, and had suggested taking over the pipes for Government purposes. The contractors had referred them to the Council, as the pipes could not be replaced on such favourable terms. The Clerk pointed out that the Government would not lend money to the Council. It might be years before they would be in a position to go on with the work; and if they took up money, it would mean that they would have to pay heavy interest charges. He thought their reply should be that they were content that the pipes should go, if the Government would release them from any obligation. It was decided that the suggestion made should be put before the Local Government Board.

NAPHTHALENE TROUBLES

have become more prevalent. The use of the

'SIMPLEX' VAPORISER

is a sure and speedy cure for this bugbear.

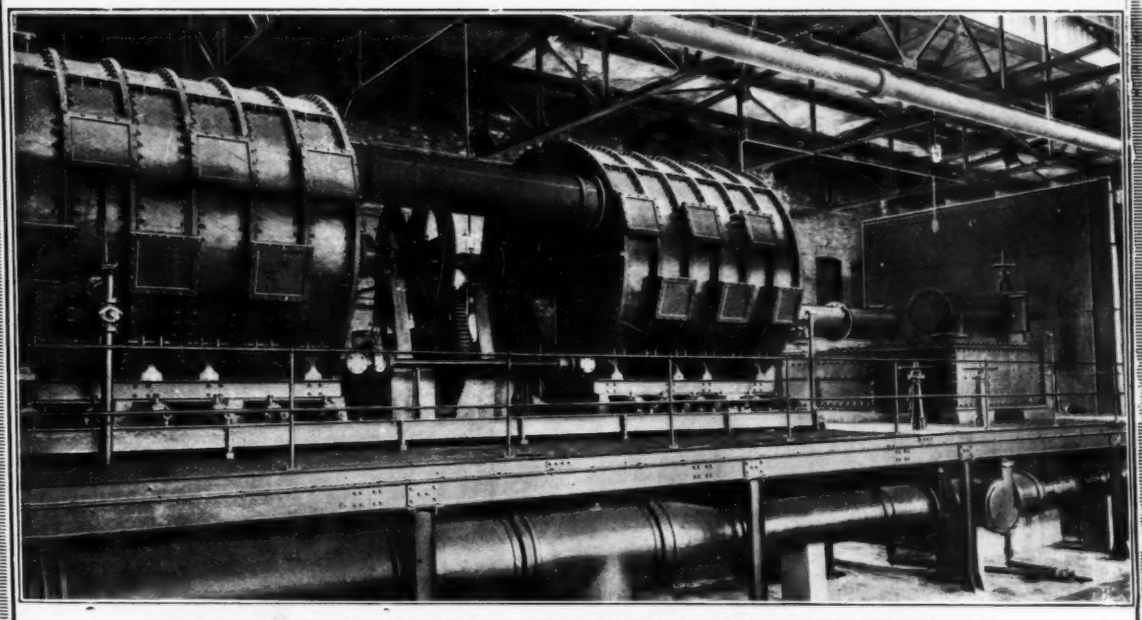
PARTICULARS CAN BE OBTAINED FROM

MESSRS. ROBERT DEMPSTER & SONS, LTD., ELLAND.

W. C. HOLMES & Co., Ltd.,

Telegrams: Holmes, Huddersfield.
Telephone: 1573 Pte. Bch. Exchange.

HUDDERSFIELD.



FIRST UNIT OF COMPLETE CONDENSING AND WASHING PLANT.

CAPACITY 10,000,000 CUB. FT. PER DAY

At the New Works of THE MONTREAL LIGHT, HEAT, AND POWER COMPANY.

CARBURETTED WATER GAS.

ECONOMICAL GAS APPARATUS CONSTRUCTION CO., LTD.

announces

REVOLUTIONARY IMPROVEMENTS.

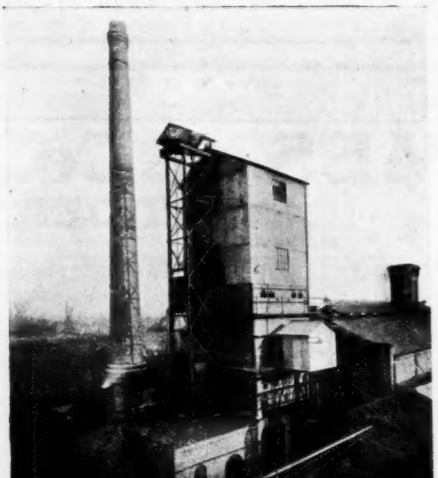
36, Victoria Street, London, S.W.

WOODALL-DUCKHAM Verticals Types of Plant.

Plants Erected and in Course of Erection.

BOURNEMOUTH
POOLE
LONDON (Nine Elms)
LONDON (Kensal Green)
BURNLEY
LAUSANNE
LUTON
LA GRANGE, U.S.A.
DRESDEN
IPSWICH, Queensland
POOLE (II.)
SMETHWICK
HULL
DERBY, U.S.A.
TOTTENHAM
BUDAPEST
YOKOHAMA
LUTON (II.)
BIRMINGHAM (Windsor St.
" (Nechells)
SPALDING
STRANDVEI, Denmark
HOLYOKE, U.S.A.
BIRKENHEAD
BRISTOL
CLECKHEATON
KINLOCHLEVEN
TOULOUSE
WEST BROMWICH
MARGATE
HYDE
IPSWICH
BOLTON
ABERDEEN
DERBY, U.S.A. (II.)
POOLE (III.)
SMETHWICK (II.)
NICE
WANGANUI, N.Z.
SCHENECTADY, U.S.A.
BROCKTON, U.S.A.
NEW HAVEN, U.S.A.
GREENOCK
AYR
MARSEILLES
MONTBELIARD, France
DUNDEE
ST. ETIENNE, France
SOUTH SHIELDS
WALLASEY
LONDON (Kensal Green) (II.)
KENDAL
IRVINE
ROWLEY REGIS
HAMILTON
HARROGATE
TUNIS
BRENTFORD
CANNOCK
PRESCOT
GLOSSOP
WORKINGTON
HULL (II.)
NORMANTON
MESSENA SPRINGS, U.S.A.)
BIRMINGHAM (Swan Village
BRADFORD
MELBOURNE
BERGEN, Norway
TRONDHJEM, Norway
ELLESMERE PORT
TOTTENHAM (II.)
PORTSEA ISLAND
NEWTON-ON-AYR
FORFAR
NOTTINGHAM
CUPAR
NEWTON-IN-MAKERFIELD

Quarter Million Plant. Self-contained.
No house necessary.

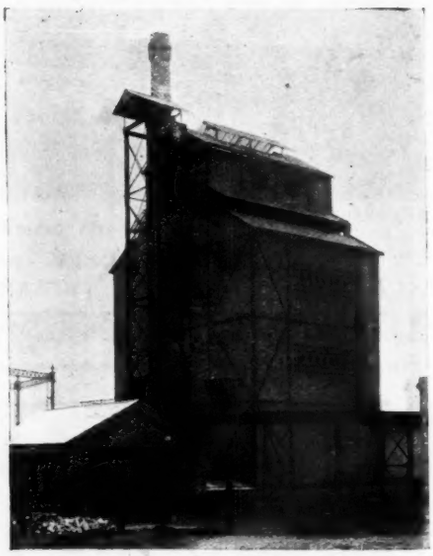


As erected at Spalding

Saving of Labour.

Quarter Million Plant in house.

Saving of Ground Space.



As erected at Rowley Regis.

The WOODALL-DUCKHAM · VERTICAL · RETORT *and* OVEN · CONSTRUCTION · COMPANY · LTD.
Palace Chambers · Westminster S.W.

REGISTER OF PATENTS.

Gas-Lamp Automatic Connecting, Suspending, and Lowering Device.

STEVENSON, J., and WILLIAMS, O. R., of Darlington.

No. 21,706; Oct. 29, 1914.

This invention is to enable a lamp to be suspended on a span wire at a convenient position over a street and at the same time to allow of it being automatically mechanically suspended on the span rope and automatically connected through to the gas supply, conveyed to a fixed convenient position on the span wire, for lighting the thoroughfare. The arrangement is such that the supply can be automatically connected to, or disconnected from, the source of supply on the span wire, and the fitting slightly lowered and taken to the side, mechanically suspended, released, and lowered at any convenient position at the centre or side of the street, and again raised on to suspension and taken out on its trolley support, suspended, to the source of its supply and automatically again connected from the source of supply to the lamp. All operations are carried out by a specially designed combined twin winch which allows of a free feed of the wire from one drum, and a self-sustaining winch for raising, lowering, and side-traversing, and *vice versa*, both working in conjunction to effect the necessary movements—the winch being so designed that, should the fitting not be properly suspended, the drum is locked and cannot be released until it is securely suspended. The locking and unlocking are effected by the weight of the lamp tension on the rope and the sag of the rope when freed from the weight.

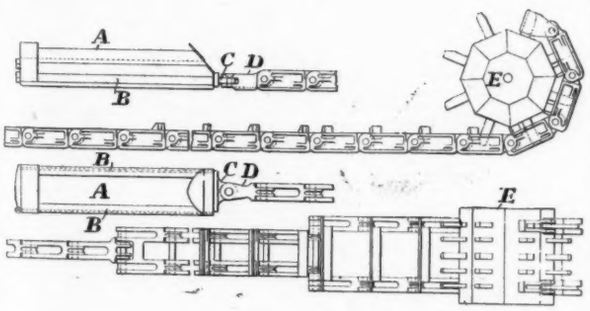
The means for carrying out the invention are described in a lengthy specification of more than seven printed pages, with a page of "claims" and three sheets of detail drawings.

Charging and Discharging Retort Machines.

ALDRIDGE, J. G. W., of Victoria Street, S.W.

No. 22,066; Nov. 5, 1914.

This invention relates to multiple-stroke charging machines for gas-retorts (applicable for discharging "through" retorts), comprising a charging receptacle or scoop with a hinged push-plate at the forward end for pushing-out the coke and a chain or jointed push-bar or ram connected with the rear end for moving the scoop into and out of the retort. The scoop is constructed like the charging member in the Fiddes-Aldridge machine—of suitably connected and spaced side-plates with a swinging push-plate in front; the scoop being bottomless and moved into the retort over an apron plate which forms a bottom for the scoop outside the retort.



A side view and plan are given of a charging chain and scoop constructed according to the invention; also a front and side elevation of the wheeled supporting framing of the machine.

The bottomless scoop A, consisting of two side plates B connected at the forward end by an arched stay and carrying in front a hinged push-plate, is closed at the rear end, and to it is attached a connecting member C, which is in turn jointed to the front link D of a butt-jointed chain. The chain is made in three sections of different widths—the length of each section corresponding with one convolution when the chain is wound on the polygonal drum E. The rear section of it is formed of parallel slotted side links pivotally connected by pins at the joints, and spaced apart by cross stays so disposed as to leave a free space between the side links for the accommodation of the links of the contiguous section when the chain is wound up. The drum, through which the chain and attached scoop are actuated, is built-up of cast-iron segments with radial teeth fixed in it, and arranged to engage the slots in the links of the chain. An apron plate F, on which the scoop rests when being filled with coal, is mounted on wheels which run in guides in a guide-frame in the machine. The apron plate is advanced towards the retort or withdrawn by (say) weights and gear, or the scoop itself may engage and actuate the apron plate as it is driven into, or withdrawn from, the retort.

For filling the scoop with coal, a telescopic shoot G, depending from the hopper H, is provided at its lower end with doors mounted to slide horizontally in guides and having pin and slot connections with pivoted arms or levers, which are, in turn, connected by links with levers carried on a rocking shaft, on which depending or striking arms are fixed to project into the path of stops on the sides of the charging scoop.

The winding drum E, motor L, chain and scoop A, apron plate F, shoot G, and feed hopper H, are compactly mounted in a wheeled frame M, provided with a controlling platform N, and adapted to be traversed along the retort-house in front of the retorts in the usual manner—the shoot and charging members being vertically adjustable in the frame to suit the different heights of retorts.

In the operation of charging a retort, the scoop having been drawn back and filled with coal, the chain and scoop are first advanced—the projections on the scoop engaging spring or other catches on the apron plate to cause the plate to move outwards with the scoop. This movement of the scoop and apron plate continues until the apron plate is stopped against the retort mouthpiece when its catches are forced open (or the weights and gear brought to a standstill) by the further advance of the scoop, which continues its forward movement, pushing the charge of coal off the apron plate and along the retort-bed.

During the advance of the scoop from the filling position towards the mouth of the retort, the depending or striking levers on the feed shoot G are operated by projections on the scoop to close the doors of the shoot. Likewise, on the return stroke of the scoop after depositing the charge of coal in the retort, the apron plate is drawn back by stops, and the levers actuating the doors of the shoot are swung back on the scoop to open the doors and allow the scoop to be refilled with coal from the hopper on the machine.

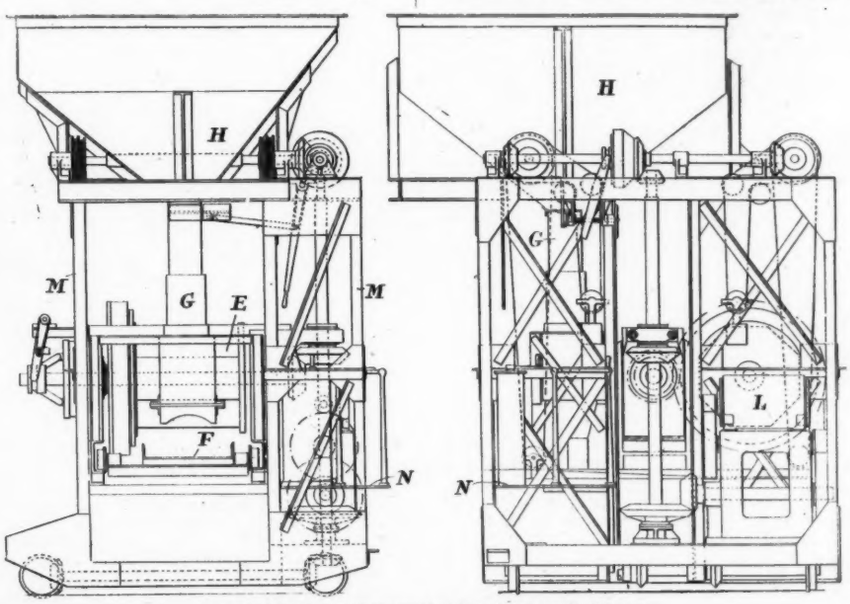
Clockwork Apparatus for Lighting and Extinguishing Gas-Burners.

CANOVA, V., of Birmingham.

No. 22,021; Nov. 4, 1914. No. 1416; Jan. 28, 1915.

This combined invention relates to clockwork controlled valve apparatus for lighting and extinguishing gas-burners, in which a spring-urged lever connected to the valve moves into one operative or raised position by one of a pair of cams engaging a roller on the lever—the cams being carried adjustably upon a dial divided into day and night portions, and held in such raised position by means of a spring-urged latch until, by the action of the second cam on the latch, the lever is allowed to fall to its other operative or depressed position.

The principal feature of the apparatus shown consists in a clock-



Aldridge's Retort Charging and Discharging Machinery.

work controlled valve in combination with a spring trip lever having on its upper side an arm carrying a friction roller in the path of cams adjustably mounted upon a dial provided with a notched edge—the trip lever having direct connection with the valve.

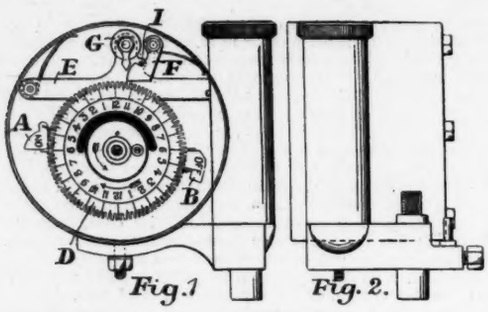


Fig. 1.

Fig. 2.

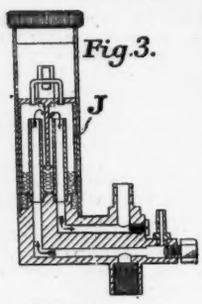


Fig. 3.

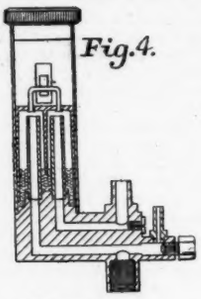


Fig. 4.

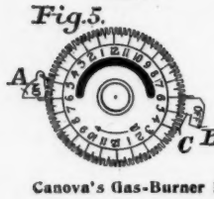


Fig. 5.

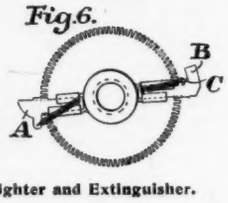


Fig. 6.

Canova's Gas-Burner Lighter and Extinguisher.

Fig. 1 is an elevation of the device with the cover removed so as to show the general arrangement of the working parts. Fig. 2 is a side elevation of the gas outlet and inlet valves in their relative positions. Figs. 3 and 4 show in section the gas-valve in the open and closed positions. Figs. 5 and 6 show a front and back view of the dial with the cam projections attached to it.

The operation of the invention is as follows: The hour for lighting is set by means of the cam A, which is moved over the dial face D to the desired time indication. The other cam B has an extension C to contact with the pawl F, and is also set to extinguish at the desired hour. The dial D now rotates under clock control. As the lighting or "on" cam rotates with the hour disc, it engages the roller G mounted on the lever E, lifting the same. At its point of greatest lift (or immediately prior thereto), it is arranged that the pawl F is engaged by means of its hooked part to the pin I on the lever E, thus holding it up. This lifts the cap of the gas-valve J admitting the supply of gas to the burner, where it is ignited from the bye-pass in the usual manner.

Further rotations of the dial D brings the "off" or extinguishing cam B into operation. It lifts the roller G sufficient to free the pin I from engagement with the pawl F. The projection C, on the under side of the cam B, now engages the pawl and presses it out of contact with the pin I; this action being continued after the cam has left the face of the roller G, so that the lever E is free to drop into its lowest position and thereby act upon the gas-valve J and extinguish the light. After the pin on the under side of the cam B has passed the pawl, the latter, under the influence of a spring K, returns to its inoperative position, which is relatively fixed by the stop-pin I. In order that the setting cams can be easily manipulated by inexperienced persons, they have a protruding finger-piece which allows of their being easily grasped, raised, and set; a pointer dependent from the roller shaft on the valve lever F indicating, by means of a vernier cut on the cam, the exact point at which the valve operates to light or extinguish. Thus the whole of the operative parts of the device are immediately available directly the cover which entirely encloses the apparatus is removed—the winding shaft of the clock mechanism being central with the hour dial.

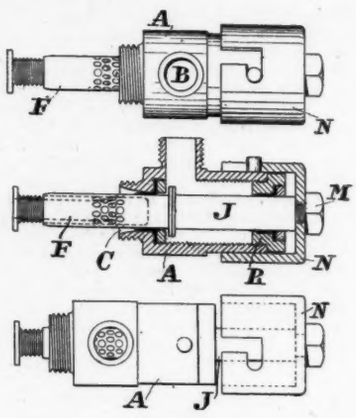
Cocks or Valves.

TURNER, WILLIAM, of Sheffield.

No. 22,096; Nov. 6, 1914.

These cocks or valves have a barrel with inlet and outlet openings provided with a perforated tube enclosed at one end and disposed in one of the openings in such a manner that it is capable of being moved longitudinally so as to increase or decrease the amount of gas or the like passing through the perforations. The perforated tube is preferably secured at one end to a cap fitting over the barrel, and locked to it by a bayonet joint. The open end of the hollow tube is provided with an adjustable internal sleeve to reduce or increase the operative number of perforations in the tube as desired.

The cock referred to is particularly adapted for use in clearing service pipes by compressed air, gas, or the like—the inlet of the cock being connected to a reservoir containing the compressed air or gas and a flexible tube connecting its outlet to the pipe to be cleared. The connections being made, when the cap is released the contents of the reservoir will instantly force open the valve and pass through the outlet at the maximum velocity into the pipe to be cleared. If used at low pressure, a coiled spring would be placed inside the barrel to assist the inward movement of the plunger.



Turner's Service Clearing Cock or Valve.

The illustration shows a side view of a cock or valve closed, a section, and a side view of a valve open to its full extent. The barrel A is provided with orifices B and C, which perform the function of inlet or outlet according to the direction in which the gas flows through. Centrally within the chamber is a valve, which consists at one end of a perforated tube F closed at its upper end. The other end is formed of a parallel spindle J provided with a fixed collar and a loose shock-absorbing collar of fibre, so as to limit the opening movement of the valve. The end of the spindle remote from the tube terminates in a reduced threaded portion M, which carries a cap N which fits easily over the outside of the barrel, and is secured in position on the barrel by a bayonet joint. The spindle is kept parallel within the barrel by a collar of approximately the same diameter as the exterior of the chamber, but which has a reduced threaded portion R which is screwed into the interior of the barrel and holds the collar in position. The collar has a central bore within which is located a packing secured in position by a threaded nut screwed into a recess in the collar.

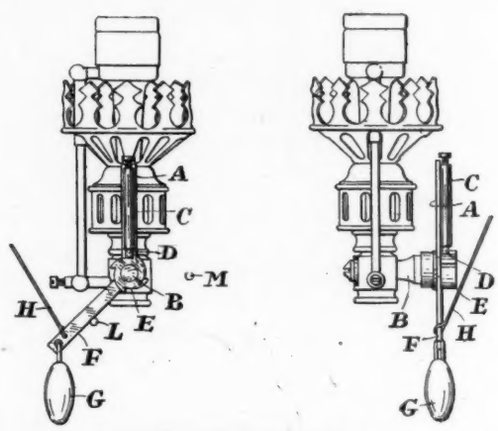
When the cap N is locked by the bayonet joint no air or fluid can pass through the barrel A, as the perforations are outside the packing E; but if the cap is released, the spindle J and tube F will be forced by the pressure behind it, thus bringing the perforations within the chamber A, and consequently any air or gas passing up the tube will pass through the perforations into the barrel and thence out by the orifice B.

Controlling Gas Valves and Cocks.

TROQUAY, J., of Kentish Town, N.W.

No. 9296; June 24, 1915.

This invention is shown in connection with a bye-pass gas-burner—a front and side elevation.



Troquay's Gas-Burner Tap Controller.

In carrying out the invention, an actuating or rocking member A is loosely pivoted on a prolongation of the plug B, and is fitted with a tube C in which a plunger D is slidably mounted under the influence of gravity. It is disposed above, and engages with, a ratchet-wheel E secured on the prolongation of the plug. An arm F of the member A is counterweighted by a hanging weight G, and has one end of some flexible member H secured to it. The pulling of H causes the member

A to rotate the valve or plug B through a quarter of a revolution, by medium of its plunger D engaging one of the teeth of the wheel E. In this way the valve is opened or closed and the gas turned on or off according to the position of the valve before the apparatus was operated. When H is released by the operator, the actuating member A returns by medium of its counterweight to its normal position, without rotating the valve or plug. Stops L M limit the movements of A; while the weight of the plunger D maintains it in engagement with the wheel E during the operating and return movements of A.

APPLICATIONS FOR LETTERS PATENT.

16,831.—Cross, F. W., "Gas-meter valves." Nov. 30.
16,891.—White, A. E., "Coal gas generating." A communication from the Riter-Conley Manufacturing Company. Dec. 1.
16,905-6.—Brown, D. A., "Gas-furnaces." Dec. 1.
16,932.—Tully, C. B., "Manufacture of hydrogen or a mixture of hydrogen and carbon monoxide." Dec. 1.
16,945.—Wootten, E. D., "Gas-producer." Dec. 2.
17,045.—Carroll, L. D., "Production of gas." A communication from J. M. Rusby. Dec. 3.
17,046.—Carroll, L. D., "Gas-making apparatus." A communication from O. B. Evans. Dec. 3.
17,084.—Brown, E. W., "Gas-heated radiators." Dec. 4.
17,089.—Casbon, W., and Dunkinson, A. J., "Incandescent burners." Dec. 4.

War Allowances to Employees Surcharged.—The Local Government Board District Auditor has surcharged the Camberwell Borough Council £900 in respect of payments to workmen and officials who are serving with the Colours. The Auditor states that in most of the cases the money paid by the Council, when added to the Government payments, doubled the sums available for the maintenance of the men's families.

Newry Gas Undertaking.—The Irish Local Government Board Auditor, in his report on the Newry gas undertaking, states that the accounts show a profit of over £600 for the year, despite the increased price of coal, and the fact that the works have to meet an annual payment of £1800 in respect of loans. The Chairman of the Gas Committee (Mr. P. M'Caffrey), at a meeting of the Urban Council, said they had also paid for a new gasholder. He suggested that the debt might be cleared, if they could arrange for a grant from a local bequest fund. If this were done, it would be possible, in normal times, to supply gas at 2s. 6d. per 1000 cubic feet. The Council deferred consideration of the suggestion.

LEGAL INTELLIGENCE.

RATING OF THE CHERTSEY WATER-WORKS INTAKE.

In the House of Lords, Earl Loreburn, Lord Atkinson, Lord Shaw, and Lord Parker met last Thursday to give their considered judgment in the appeal by the Metropolitan Water Board against an order of the Court of Appeal in favour of the respondents, the Assessment Committee of the Chertsey Union.

Counsel in the case were: For the appellants, Mr. Ryde, K.C., and Mr. Jacques Abady [holding the brief of Mr. H. Fletcher Moulton, serving with H.M. Forces]; for the respondents, Mr. Page, K.C., Mr. W. Mackenzie, K.C., and Mr. Laurence Tooth [holding the brief of Mr. H. Conacher, serving with H.M. Forces].

The arguments were concluded and judgment was reserved on Nov. 1 (*ante*, p. 327).

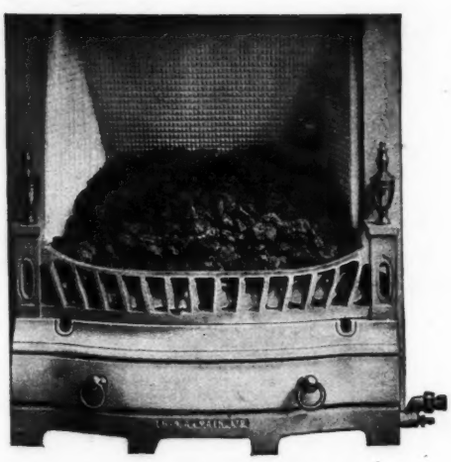
Earl Loreburn, in giving his decision, said that the Quarter Sessions had fixed, subject to a special case stated, the assessment of a strip of land some nine acres in extent belonging to the Metropolitan Water Board, and comprising an intake from the River Thames, together with buildings and works; the abstraction of water being authorized by an Act of Parliament for the benefit of the Water Board. It was an unproductive part of a great profit-earning concern, which earned its profits in many parishes.

Both the Assessment Committee and the Water Board contended, and the Quarter Sessions held, that the proper basis of assessment was to take the cost paid for the land and for erecting the buildings and works some years ago, and then to take a percentage upon the cost in order to arrive at the annual value.

But the Assessment Committee contended that there should be added a further sum as being an enhanced value in respect of the user made of the intake, and the statutory right of appropriating water withdrawn from the River Thames by means of it, and the proximity of the river for the taking of water into the Water Board's pumping tanks; and therefore the piece of land in question had an added value by reason of its special fitness for this purpose. The Committee contended that the aggregate of such percentage and enhanced value was the rent at which the premises might reasonably be expected to let from year to year; and they relied on the case of the *New River Company v. Hertford Union*.

On the other hand, the Water Board contended that no such addition should be made, because all the elements of the supposed enhanced value that were relevant had been already covered by the price or cost. They further contended that, as they themselves were the only possible tenants of these premises and stood in very good credit (being able to borrow at 3½ per cent), the rent of the hypothetical tenant

THE MAIN GAS FIRES.



The ST. NICHOLAS.

The St. Nicholas—

The Gas Fire without a rival.

The new booklet—"Main Reflections"—contains particulars of several new Gas Fires. Copies free on application.

R. & A. MAIN, LIMITED.

WORKS: Gothic Works, EDMONTON, N. Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.

SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 56, Broad Street, BIRMINGHAM; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

should be fixed, in view of their financial credit, at 3½ per cent. on the cost of the land and the works. It was put on their behalf in this way: "If we do not get a low rent, we are in a position to borrow money at a low rate and can build other water-works for ourselves, and the interest on our outlay would be less than the rent you ask to have fixed."

Quarter Sessions rejected both the appellants' and the respondents' contentions. He would not enter upon the question whether or not their decision on such matters was final, for that was not treated as the real point in the argument. He preferred to say that he thought Quarter Sessions were perfectly right in their conclusions.

The statutory test of what a hypothetical tenant might reasonably be expected to give as rent was a rule-of-thumb, however difficult to apply, that must govern such a question. When cost was taken as a basis, it must surely be on the footing that what had in fact been paid presumably indicated capital value, and that interest on it presumably indicated annual value. When a man paid a price for the fee-simple of land, whatever fitness or capability for profitable use there existed in the land, or might run with it, was surely covered by the price he paid, unless some special arrangement was made of which there was no trace in this case. How could it be said that something should be added to the capital value or to the annual value by reason of such things as the proximity of the land to the river or its special fitness for some industrial purpose? All this had been included in the cost price. Or why should anything be added "in respect of the user made of the intake"—a phrase of which he did not grasp the meaning, beyond seeing clearly that this was not a rateable subject at all? Or how could it be said that anything should be added because the person who bought the land, or who now owned it, had a statutory right, personal to himself, of using it in a particular way and of drawing water through it from the Thames? For that did not make the land itself more valuable. It only made the owner or occupier of it more able to make profits. It might as well be said that a piece of land was more valuable because the tenant of it had a valuable patent which he worked on the land.

Coming to the claim of the Water Board, that the hypothetical rent should be "fixed" at a lower figure because they were the only possible tenants, and could borrow at less than the current rate of interest. He thought this was a singular argument, and had been properly refuted by what he had said in the Assessment Committee's case; but Mr. Page, speaking on their behalf, threw that over, and, if he understood him aright, accepted the proposition that the financial standing of the Water Board was a proper element for consideration. He thought it was certainly a wrong contention when the basis of cost was adopted. If it was permissible to regard the wealth of a possible tenant, it was permissible to regard also the wealth of the possible imaginary landlord; for the one was as relevant as the other in any conjecture as to the rent that would result from bargaining between the two.

Having dealt with other points in argument, his Lordship said he was of opinion that the appeal of the Water Board should be allowed. But as both sides had advanced untenable contentions, he moved that the order of Quarter Sessions be restored, and that there should be no costs there or below on either side.

Lord ATKINSON said the point in controversy in the case was the rule or principle to be adopted in valuing for rating purposes certain indirectly productive portions of the appellants' water-works. He thought, on a series of authorities he referred to, that it was perfectly legitimate to take into consideration what was the annual cost which the owners would be put to in acquiring the ownership of rateable hereditaments as some guide, in the circumstances, as to what rent they would be willing to pay for them if they were not the owners. It was not at all conclusive, but merely an element to be considered. Where he disagreed with the contention of the appellants on this point was that, in ascertaining the annual cost, it was wrong to take the annual market value of the capital sunk in the acquisition of the hereditaments—that is, the usual rate of interest, but merely the rate of interest at which the owner could procure the capital. Were this not so, a public body to whom some generous benefactor made a present of money to enable them to acquire land compulsorily for some philanthropic object, of which the owner approved, would presumably be unwilling to pay any rent for the enjoyment and acquisition of the land, as they could acquire it in fee for, in effect, nothing. On the whole, however, he agreed in the judgment proposed.

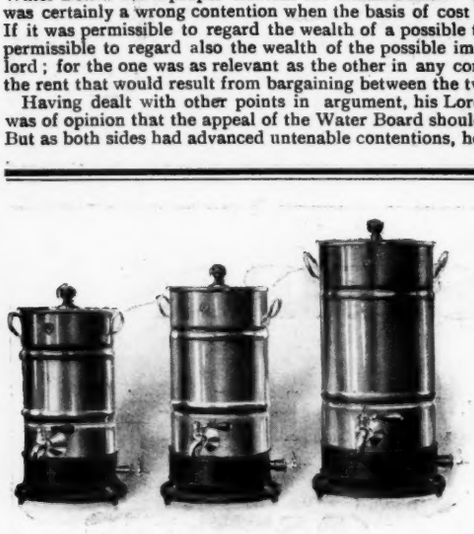
Lord SHAW also read a judgment. In dealing with the second part of the case, his Lordship pointed out that if the contention of the Water Board were upheld, it might lead to startling results. A clever financier could show the valuation authority that he could borrow money on easier terms than his neighbours; and therefore—so it would be argued—the rateable value of his land had gone down. This advantage would be countered by the disadvantage of the poorer owner of a similar plot; and the heavier the latter's burden of interest the higher would be the value of his landed property. This was unarguable; and he would only add that a further startling result would follow—that when the terms of public loans became more onerous, the rateable value of hereditaments would be increased. Such were the dangers of confusing personal advantages with those inherent to the land. He agreed with the judgment proposed.

Lord SHAW then read a judgment by Lord PARKER, who agreed to the appeal being allowed.

Order accordingly, no costs to either side, there or below.

CONSTRUING A WATER SUPPLY AGREEMENT.

In the Chancery Division of the High Court of Justice last Tuesday, Mr. Justice SARGANT heard an action in which the Tynemouth Corporation asked for an injunction restraining the Newbiggin-by-Sea Urban District Council from supplying water to places outside the area constituted by an agreement dated April 17, 1907, between the two



Range of Three Davis Copper Urns.

Some Views of the Large Gas Cooking Apparatus supplied by The Davis Gas Stove Co., Ltd., to the principal Military Hospitals, including the

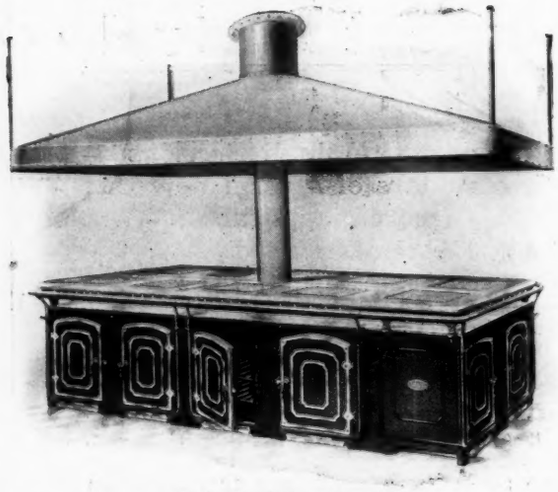
KING GEORGE MILITARY HOSPITAL,

(Stamford St., London, S.E.)
accommodating some 1500 soldiers.

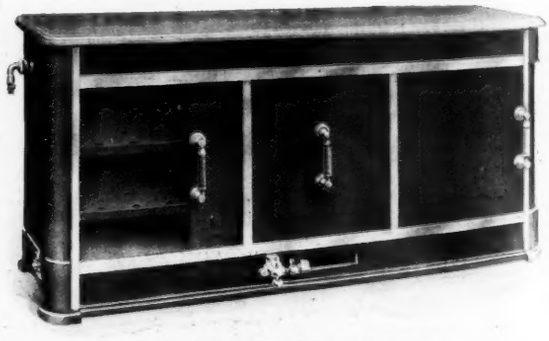
Address all enquiries for this and similar apparatus to

THE GAS EXHIBITION SALONS,
60, OXFORD ST., LONDON, W.

Davis Vegetable Steamer.



Davis Decuple Oven Central Range.



Davis Hot Closet with Three Sliding Doors.

authorities, under which the defendants received water from the plaintiffs. The plaintiffs also asked for damages for taking water in excess of the amount provided for in the agreement.

Mr. MARK ROMER, K.C., and Mr. J. G. WOOD were for the plaintiffs; and Mr. E. PAGE, K.C., and Mr. SCHOFIELD for the defendants.

Mr. ROMER, in opening the case, said that by their 1897 Act the plaintiffs had the power to supply water in bulk to places outside their area. They made the agreement referred to with the defendants; but, since the date of the agreement, the defendant Council's area had been increased. The question was whether the agreement compelled the Corporation to supply water to the added area. The defendants had set up, in their defence, a plea of estoppel by conduct; saying that because of what one of their officials had omitted to do in 1909, the plaintiffs were now estopped from raising the point. The plaintiffs said that their Act enabled them to supply the borough and the township of Whitley and Monkseaton; and the agreement with the defendants cited that the latter should take the whole of the supply required for the urban district. Since then, some additions had been made to the defendants' district. In December, 1911, defendants inquired whether plaintiffs would be prepared to supply water to the added area. The reply was that the existing agreement had reference only to the area of the district at the date of the agreement; but they were prepared to negotiate an agreement on a different basis. No arrangement was reached; and the negotiations were broken off in September, 1912. But in February last year they were re-opened, when the plaintiffs discovered that the defendants were already using the water for the added area. An offer was made to the defendants; but this was not accepted, and they were continuing to take the water from the gravitation main, thereby making considerable profits. The defence inferred that the defendants were encouraged to lay their communication main; the plaintiffs knowing full well that they were entitled to supply the added area. He submitted that it was not reasonable to expect that they were to supply the urban district of Newbiggin, however large it might become.

Mr. PAGE, in the course of the arguments, intimated that the defence withdrew the plea of estoppel.

His LORDSHIP, in giving judgment, said it was impossible to suppose that the plaintiffs knew a supply was being given to an added area, when at the time they were contending that the district of supply was the original district, and were demanding very much higher terms for a second area. On the question as to the constitution of the district, he said that in his opinion the Newbiggin urban district must mean the original district. One definite area was marked as the area to be supplied. It would cast a burden on both parties if the agreement was to be deemed to extend to a district that might be twenty times as large in the future. He gave judgment on the construction of the agreement in the plaintiffs' favour.

Mr. ROMER suggested that the injunction should be granted and suspended for six months, to give the defendants time to make arrangements for a supply of water for the added areas, and that in the meantime the supply should be at the rate of 7½d. per 1000 gallons, without prejudice. With regard to the water already used, the plaintiffs were willing to accept nominal damages.

After some discussion, the damages were fixed at £5; and it was agreed that water for the added areas should be paid for at the rate of 6d. per 1000 gallons—the defendants to fix meters. The injunction was to be suspended for six months.

MISCELLANEOUS NEWS.

SIR CORBET WOODALL'S CHRISTMAS GREETING

To Gas Light and Coke Company Co-Partners.

The following Christmas Greeting from the Governor (Sir Corbet Woodall, D.Sc.) occupies the first page of the December issue of the Gas Light and Coke Company's "Co-Partners' Magazine."

Again I rejoice in the opportunity of wishing all co-partners "A Happy Christmas."

To-day, as at Christmas last year, we are living in an atmosphere of strife, and cruelty, and suffering, which is at the same time one of splendid effort and noble self-sacrifice. Last year we knew something of the greatness of the war; but imagination did not reach to what it has now become.

We and our Allies are fighting on many fronts—even over the reputed Garden of Eden, the cradle of our race. Millions of men are engaged upon the various fields in Europe, Asia, and Africa; and millions more are striving with all their strength in the workshops of the world in preparing guns, munitions, food, and clothing for the soldiers and the sailors.

We of the Gas Light and Coke Company are working among the rest; and it is for each and every man of us, whether in the front or at home, to satisfy himself that he is leaving nothing undone that is possible to him. We have to win the war; to fail would mean the break-up of our Empire and the reduction of Great Britain to the condition of Belgium or Serbia. We must win the war, if only to punish those who have so richly deserved punishment. To do this, will mean the putting forth of every effort we can make.

Especially to those at home I would say, "Think constantly of our brothers, our sons, our friends, and what they are doing abroad and at sea; and let us solemnly vow to leave nothing undone that is possible to us to cheer and help them on to victory." When the end comes, and victory is won, it will be well if, amid all our sorrow and all our pride in the lost ones, we knew that we also have done our best.

And so, with Tiny Tim on his Christmas Day, I pray—

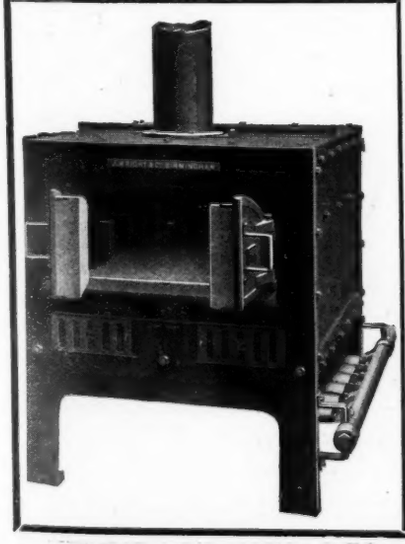
"God bless us every one."

GAS FURNACES

For Heating, Annealing, Hardening, Tempering, &c.

FOR

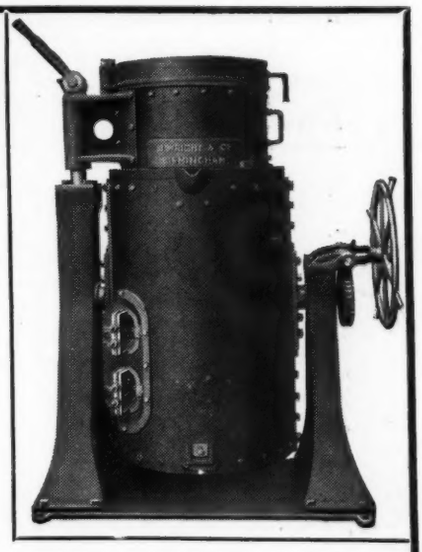
MUNITION WORK,



MELTING

Aluminium,
Brass,
Copper,
Lead,
Stereo Metal, &c.

ENAMELLING,
LACQUERING,
JAPANNING,
POTTERY FIRING,
GLASS BLOWING, &c.



If you will send us a list of Firms in your district who should be using Gas Furnaces, we will send a Representative to interview them in our mutual interests.

JOHN WRIGHT & CO.,

ESSEX WORKS, ASTON, BIRMINGHAM.

GAS-WORKERS' DISPUTES.

Some time ago, the Barnsley Gas Company's employees, without having first obtained the consent of their Union Executive, handed in their notices; and when this was brought to the attention of the District Secretary (Mr. C. H. Blackburn), he did what he could, by opening up negotiations with the Company, to avert a stoppage. Interviews took place with a view to a settlement; but these being unsuccessful, both parties agreed that the matter should go to arbitration. The proceedings took place recently at the Company's offices, in the presence of Mr. Doughty, of the Industrial Commissioner's Department. The case for the men was put by Mr. Blackburn, and that for the Company by Mr. E. G. Lancaster (the Chairman), and Mr. H. Hutchinson (the Engineer and Manager). After the conference, the works were visited by Mr. Doughty, who promised to give his decision at the earliest date. It is expected that a satisfactory settlement will be arrived at; and meantime the men agreed to remain at work.

At Paisley, the gas workers who recently went on strike, refusing the Town Council's offer of arbitration in connection with their claim for an increase of wages, subsequently returned to their employment, having agreed to the Corporation offer. During the strike the stock of gas was maintained by the military; and before the workers returned it had been largely increased. The pressure, which had to be cut down owing to the deficiency caused by the suspension of work, was raised again as soon as the soldiers had the works in full operation.

At the week-end, considerable inconvenience was experienced at Aberdare, owing to a strike at the gas-works. Evening services were interfered with on Sunday; and at the railway station and in the signal boxes lamps and candles had to be requisitioned. The gas-workers ceased working on Saturday morning; and their demands were conceded during the day. They refused, however, to re-start until the fresh terms were embodied in a new agreement.

LEIGH (LANCS.) GAS AND WATER SUPPLIES.

Reports on the working of the Leigh (Lancs.) Corporation gas and water undertakings for the year ended March 31 last have been presented to the Gas and Water Committee by Mr. James Gibson, the Engineer and Manager.

The gross profit for the year on the Gas Department was £9865, being 5·36 per cent. on the capital invested in the undertaking. After deducting sinking fund and interest charges, £10,080, equal to 1s. 3·75d. per 1000 cubic feet of gas sold, there was left a loss of £215, which was further increased owing to special charges having been met—viz., £160 for slot-fittings, £45 for depreciation of meters, and £71 for allowances to workmen on military service—leaving a net loss of £491. During the year 257 new services were laid. At the beginning of the year there were on the register 2618 ordinary and 6841 prepayment consumers; and by the end of the year ordinary consumers had decreased by 45, or 1·71 per cent., while prepayment meter users had increased 273, or 3·99 per cent. Thus the total number of consumers at March 31 last was 9687—an increase of 228, or 2·41 per cent. The number of public lamps was increased by 20, to 905; but of these, on March 31, only 472 were in lighting.

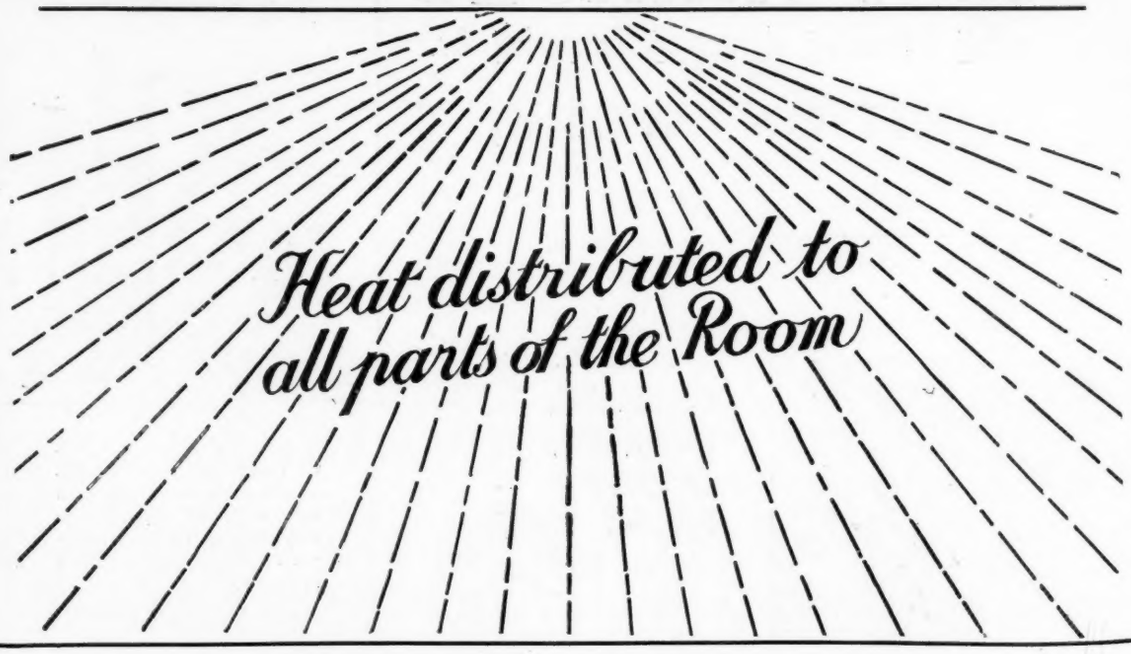
The coal carbonized in the twelve months amounted to 15,035 tons; while the quantity of gas sent out was 165,344,000 cubic feet, or a decrease of 2·03 per cent. on the preceding year. The decrease in consumption was largely due to the War Office lighting conditions prevailing in the borough. At the end of the financial year, there were 25 gas-engines connected with the mains; and during the twelve months 2,253,900 cubic feet of gas were sold for power purposes, as compared with 1,869,700 cubic feet the year before. The total quantity sold for manufacturing purposes was 4,294,500 cubic feet. The make of gas per ton of coal carbonized was 10,800 cubic feet, and the sale 10,030 feet. This was considerably less than in the preceding year; but the difference may, Mr. Gibson says, be accounted for by the new retorts not having the proper heats, caused by the defective draught of the chimney, thereby producing less gas per ton of coal, and also by the change in the collections from slot-meters from three to only two per quarter.

The loss on the undertaking, compared with 1913-14, is accounted for as follows: Decrease in price of gas for power and manufacturing purposes, and also to prepayment consumers, £232; loss on residuals —sulphate, tar, and coke, £977; increase in interest and sinking fund charges, £174; increase in price of coal, oil, carting, &c., £249; and increase in repairs and maintenance caused mainly by the preparation and starting of the vertical installation, £403. During the current year there has been an increase in the price of coal of 5s. to 5s. 6d. per ton; but there will be some slight reduction in these prices, owing to the passing of the Coal Price Limitation Act. In consequence of the increase in the price of coal, the Committee increased the price of gas 6d. per 1000 cubic feet from July 1.

At the close of the financial year, the capital invested in the works (excluding the cost of a scrubber-washer, exhauster, and carburetted water-gas plant) was £184,062, or at the rate of £12 4s. 10·14d. per ton of coal carbonized, £1 2s. 3·17d. per 1000 cubic feet of gas made, and £1 3s. 11·6 d. per 1000 feet sold.

The revenue account of the water undertaking shows a loss of £935, as compared with a loss of £573 for the previous year. The total quantity of water received during the year from the Liverpool and Manchester Corporations was 300 million gallons. The houses and other premises supplied on assessment were 8839, and by meter 791. Taken on the population supplied—*i.e.*, 45 000—the consumption per head per day was 18·12 gallons; and leaving out the water used by meter for trade purposes, the quantity was 14·14 gallons per head per day for domestic purposes.

Richmond's New "R.H.D." Gasfire.



THE RICHMOND GAS STOVE & METER CO., Ltd.,
Academy Street, Warrington. 132, Queen Victoria Street, E.C.

AUTHORIZED PLUMBERS' CERTIFICATES.

A Question at St. Helens.

Is it legal for municipalities to publish lists of authorized plumbers? This question has lately been engaging the attention of the Institute of Plumbers, because of the refusal of the Water Committee of the St. Helens Corporation to recognize the Institute's certificate of competency. The Water Committee only take cognizance of the certificate of the Worshipful Company of Plumbers, and they accordingly stipulate for this. When a certificated plumber belonging to a well-known Manchester firm was instructed to execute certain plumbing work at St. Helens, they intimated that they would decline to give a supply of water, unless the work was carried out by a holder of the certificate of the Company of Plumbers—notwithstanding the fact that the contractor employed held the first-class honours certificate of the City and Guilds of London Institute and was also certificated by the Royal Sanitary Institute.

The Institute of Plumbers having repeatedly sought an interview with the Water Committee without success, have now taken advice on the legal aspect of the question; and they have been informed that a lawsuit would probably succeed. But a final decision as to an appeal to the Courts has been deferred for the present, in order that the fullest information may be available. It is felt that the St. Helens Water Committee have not acted reasonably in declining to hear a deputation from the Institute. Discussing the matter, Councillor Burkenshaw, of Oldham, remarked that the St. Helens Corporation have definite powers for the authorization of plumbers; but he was informed that, if work is done in accordance with the bye-laws, there was no power to stop it being connected-up. If a public supply of water was refused, the Corporation, he was told, would be liable for damages.

GAS SUPPLY AND HIGH EXPLOSIVES.

[From the "Eastern Daily Press," Norwich.]

References to the part that gas supply is taking in helping the State to successfully prosecute the war, may have been observed in the Press from time to time; and it has doubtless come as a surprise to many people to hear that extracts from coal gas play such an important part as raw material for the production of high explosives. The question will pass through many minds as to how coal gas is affected, and what is the nature of the extractions.

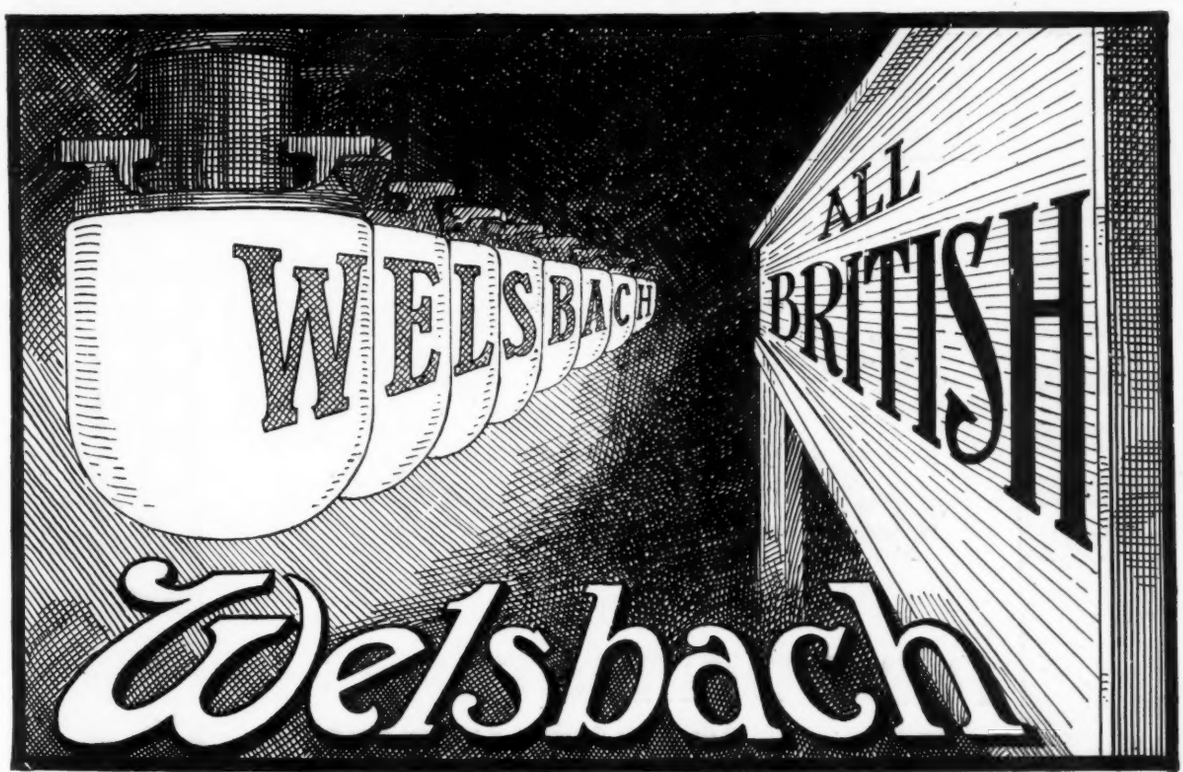
To answer the last question first, we may say that benzol and toluol are the two chief products required; benzol having a chemical composition of 6 atoms of carbon and 6 atoms of hydrogen, while toluol contains 7 atoms of carbon to 8 atoms of hydrogen.

These constituents of coal gas are present as a vapour under ordinary conditions; but when extracted and rectified they have the physical properties of a spirit, and are comparable in many ways to petrol, for which they can be used as an efficient and more powerful substitute. Petrol, however, cannot be used in place of benzol and toluol for the production of high explosives. The vapour of benzol and toluol, when present in small quantities in gas, gives that luminosity to the flame with which we were familiar in times past, before the introduction of the mantle burner and the electric glow lamp. There can be few of the self-luminous flame burners in use now; and this is fortunate, as it allows of greater freedom on the part of gas supplying authorities to comply with the demands of the State, without danger of injuring the interests of the large number of people who consume gas. As we have said, there are few luminous flame burners now in use. Those consumers who have clung to this now obsolete method of obtaining artificial light will do well to replace them by the more economical and efficient mantle burners, which use blue atmospheric flames, like those on cooking and other gas-heating appliances.

What will happen when the war is over, and the War Department no longer require urgent supplies of spirit? Will the gas-works become the source of supply of motor spirit, and so save purchasing from abroad? This is likely to be the case, and gas consumers will in the end get the benefit of these changed methods of manufacture and use of gas, as it is a well-established policy adopted by gas companies to allow their customers to share the benefits of any economies and improvements that may be made.

Increase in Price at Lincoln.—On the recommendation of the Gas Committee, the Lincoln City Council have resolved to increase the price of gas 3d. per 1000 cubic feet; this being the second increase during the year, and bringing the price to 2s. 6d. Alderman White stated that the price for electricity would also have to be raised on Jan. 1.

Money Sanctioned for Retorts at Stafford.—With regard to the recent fire at the Stafford Gas-Works, the Chairman of the Gas Committee stated at last Tuesday's meeting of the Town Council that the damage would not be so extensive as was at first feared. A Sub-Committee had been appointed to ascertain, if possible, what was the origin of the fire, though he was not sanguine of success. Just before the outbreak of war, the Gas Committee submitted a scheme to the Local Government Board for the extension of the gas-making plant by the erection of new retorts and a new holder. The scheme was approved by the Board; but their sanction to the borrowing of the money was withheld. Representations have lately been made to the Board that the provision of the retorts is absolutely necessary, not only for maintaining the gas supply of the town, but for the production of material for the manufacture of explosives. It was intimated at the Council meeting that the Board have now sanctioned the raising of £20,000 for the retorts.



Write for Particulars and Samples.

THE WELSBACH LIGHT COMPANY, LTD.,
WELSBACH HOUSE, KING'S CROSS, LONDON, W.C.
AND AT BIRMINGHAM, MANCHESTER, LEEDS, STOKE-ON-TRENT, HULL, BRISTOL, AND DUBLIN.

Welsbach Mantles are Upright (C, CX, and Plaissetty) and Inverted.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec.* 13.

Pitch remains unchanged at 20s. net per ton. Creosote is quoted 4½d. to 4¾d. net in bulk; solvent naphtha, 2s. 2d. naked; anthracene, 40-50 per cent., 2¾d. per unit, casks free—all *ex* makers' works. Benzol, toluol, and carbolic acid are still under official control. Some contracts for freed-tar for use on the roads during next season are now being placed.

Sulphate of ammonia continues very strong, and £16 10s. net per ton has been paid for 25 per cent. quality, filled into buyers' bags at makers' works, for prompt delivery.

*** In last week's report, the price of creosote was, through a printer's error, given as 4½d. instead of 4¾d.

Tar Products in the Provinces.

Dec. 13.

The market for tar products is still very quiet. Distillers in some instances are willing to accept the low prices which are ruling for pitch at the present moment. Creosote is being offered at low figures. Solvent and heavy naphthas are in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 18s. 6d. to 22s. 6d. Pitch, East Coast, 15s. 6d. to 16s. 6d. per ton; West Coast, 15s. to 15s. 6d. Manchester; 16s. to 16s. 6d. Liverpool; 17s. to 18s. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 1s. 11d. to 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2¾d. to 2¾d. Heavy oils, in bulk, 3⅝d. to 4d. Carbolic acid, casks included, 60 per cent., East and West Coasts, 3s. 6d. Naphthalene, £18 to £28; salts, 75s. to 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Dec.* 11.

Throughout the week the market for this material has continued without interruption its upward course, and another record in high prices for the past thirty years has been established. The exports for the last month show an increase of 5686 tons as compared with those for November, 1914, and there has been no slackening in the demand from abroad for shipment from now up to April next. The closing quotations for December delivery are £17 per ton f.o.b. Hull, £17 5s. f.o.b. Liverpool, and £17 7s. 6d. f.o.b. Leith. In the forward position, values have moved in sympathy with those for near delivery, and it is reported that business has been done at the best ports at £17 10s. per ton for January-March, £17 for April-June, and £16 10s. for July-December.

Nitrate of Soda.

The market for this material has also advanced further, and holders on spot now require 14s. 10½d. per cwt. for ordinary, and 15s. 10½d. for refined quality.

Sulphate of Ammonia.

From another source, it is stated that there has been a further rise in the market for this article during the past week. Outside London, makes to-day are quoted at £15 12s. 6d. to £15 15s.; Hull, £16 12s. 6d.; Liverpool, £16 15s. to £16 17s. 6d.; Leith, £16 17s. 6d.; Middlesbrough, £16 15s.

COAL TRADE REPORT.

Northern Coal Trade.

The northern coal trade is steady, and deliveries are fairly good. But there is not now much coal free for sale for the rest of the month; so that the tendency of prices is firm on the whole. In the steam coal trade, best Northumbrians are from 20s. to 21s. per ton f.o.b. for prompt supplies; second-class steams are about 17s. 9d. per ton; and steam smalls vary from 10s. 6d. to 12s. 9d. per ton, according to the quality. Work at the collieries is fair, when the number of men enlisted is taken into account. In the gas coal trade, the tone is steady generally; the home demand being now at its fullest. Best Durham gas coals are from 19s. 6d. to 19s. 9d. per ton f.o.b.; for second-class gas coals, the quotation is about 17s. 6d. to 17s. 9d. per ton; and "Wear Specials" are 21s. per ton. Shipments of gas coals to the Metropolis are full; but those to France are not so heavy. To Italy, the congestion at some of the ports is checking the deliveries. The freight market is rather easier; but gas coal from the Tyne to London is 15s. 6d. to 16s., and to Rouen 26s. has been paid. As the output of coal will be less for the latter half of the month, shippers will find tonnage more readily; and while gas coal will have a stiff demand, freights may show ease till the year has turned. In the coke trade, there is a heavier demand, and the exports are now above those of a year ago. Gas coke is firm, though in larger production, and the price quoted for good makes is from 27s. 6d. to 29s. 6d. per ton f.o.b. in the Tyne.

There is a proposal by the Glasgow Corporation to purchase the Thornliebank Gas-Works from the Calico Printers' Association. When the Glasgow Boundaries Bill, which included Thornliebank in its scope, was promoted in 1912, the Corporation agreed to purchase the gas-works. The village was, however, removed from the Bill, and the agreement was not carried out.

Kindly forward us YOUR enquiry to-day.

R. & J. DEMPSTER, Ltd., MANCHESTER.

London Office:
165, GRESHAM HOUSE,
Old Broad St., E.C.

Gas-Works Requirements at Lancaster.

On behalf of the Local Government Board, Mr. A. W. Brightmore last Thursday held an inquiry into an application by the Lancaster Corporation for a Provisional Order to enable them to borrow money for gas-works and other purposes. As to the gas undertaking, the Council desired the alteration of their Act of 1880 so as to enable them to borrow a sum not exceeding £80,000 for extensions. The Town Clerk (Mr. T. C. Hughes) said that the Corporation asked immediate sanction to borrow £28,000—for carburetted water-gas plant £7895, reconstruction of retorts £9698, working balance £10,000, and contingencies £7000. Mr. C. R. Armitage (the Gas Engineer) gave a survey of the works; pointing out that in 1880 the make of gas was 50,000,000 cubic feet, and last year it was 238,616,000 feet. The carbonizing plant produced 1,060,000 cubic feet per day; and the demand was for 1,048,000 feet per day. It was proposed to expend £2625 on meters and fittings for new consumers, and £1600 on new mains. The reconstruction of No. 2 retort-bench, with the carburetted water-gas plant, would produce 1,800,000 cubic feet. As the result of previous extensions, practically nothing of the old plant remained. The whole had been reconstructed and brought to its present capacity without adding a penny to capital account, except for the purchase of land. They had spent over £72,000 out of revenue. The price received for gas in 1880 was 4s. 6d. per 1000 cubic feet, less discount; and the charge to-day was 1s. 9·17d.

Fatal Acetylene Explosion.—Bernard Drury, aged 69, a gardener, of Pucklechurch, died from injuries caused by an explosion in connection with an acetylene plant. At the inquest, it was stated that something went wrong with the apparatus, and Drury started to attend to it. There was an explosion, and he was found unconscious 35 yards away. Portions of a lamp were found near him. The building in which the plant was installed was wrecked. Apparently the accident was caused by faulty connecting-up after charging the apparatus.

Price of Gas at Chesterfield.—In view of the heavy rise in the price of coal, the Chesterfield Gas and Water Board have pointed out that the increase of 4d. per 1000 cubic feet in the charge for gas to ordinary consumers will only about half meet the additional cost to the Board. The Gas Committee say: "We have felt that in these expensive times we would keep the increase as low as possible, hoping that by the increased sales of residuals we may be able to meet the high price of coal. The Committee have taken advantage of the Price of Coal (Limitation) Act, 1915, and have been able to get a small reduction on the basis of the prices paid two years ago." The financial statement shows that £251,766 was raised for the purchase of the gas and water undertakings and costs of transfer, while £165,483 had since been raised for additional works and extensions, making a total of £417,249. The amount paid off is £128,968, leaving a balance owing to March 31 last of £288,281. The gross revenue for the last financial year was £56,227.

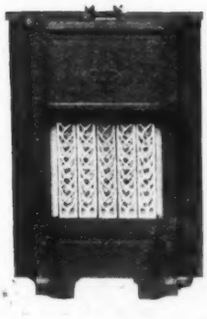
Importance of Show-Rooms.

Alderman Lowe (Chairman of the Gas and Electricity Committee) replied at some length at last Wednesday's meeting of the Burton-on-Trent Town Council to a question that had been previously raised as to the cost of the working of the show-rooms, and whether the results fulfilled the expectations of the Committee. He stated that the gas show-room cost £250 per annum, and the electricity show-room £100. There was to be added to this the interest on the money invested in the building of the show-rooms and purchase of the site, which might mean another £250, or a total of £600. It would be very difficult to say that they had made £600 as a result of the premises; but the Committee were satisfied that they were meeting requirements. The factors raised by the war—such as economy—had to be taken into consideration before saying that the show-rooms did not come up to the expectations formed when they were commenced. They were not able to push trade as in the past, because all the fittings were purchased out of revenue; and they were not able this year to place anything on one side for this purpose. As an instance of the results of the show-rooms, he said that, though there were but eleven electric fires when they were opened, there were about 163 at the present time, which indicated increased revenue. There had been an announcement in the Press of a petition signed by a number of ratepayers who desired to enter a strong protest against the continued use of the bottom shops of the museum for purposes which brought no result to the ratepayers. It was strange, but it seemed the only people who could manage an undertaking had nothing to do with it. Nearly all gas concerns in the country had show-rooms, and found the necessity for enlarging and developing them. In many towns gas was produced by private companies, who had shareholders to satisfy, yet they had expensive show-rooms, and realized their importance for furthering trade. The money spent on the show-rooms was spent in very much the same way as large manufacturers expended money in advertising. He hoped that the public would be reassured, despite the fact that it was not always apparent, that the money spent came straight back. The Committee went into the matter fully at the beginning. The figures he had given included the heating and lighting of the show-rooms. The placing of gas-fires commenced two years ago; and since then between 600 and 700 had been fixed.

German Plan for Obtaining Benzol.—Speaking at an inspection of the Manchester Corporation electricity works last week, Alderman William Kay (the Chairman of the Gas Committee) remarked that for three years prior to the war German firms had endeavoured wherever they were allowed in this country to instal coke-plants, in order to obtain benzol for exportation to Germany. They offered to put down the plant without any capital expenditure to the English firms; and the scheme was undoubtedly financed by the German Government, who were anxious to obtain the benzol for the purpose of extracting from it toluol for the manufacture of explosives.

The "LOUVAIN."

The "LILLE."



The "MONITOR."

MANUFACTURERS:

The VULCAN STOVE CO., Ld.

EXETER.

Telegrams: "VULCAN, EXETER."

Barrow-in-Furness Municipal Undertakings.—The Barrow Corporation "Blue-Book" shows that there has been spent on the gas-works £170,750, of which £58,024 has been repaid. The water-works have cost £433,482; and £117,189 has been redeemed. The electricity works have entailed an outlay of £158,480; and loans amounting to £50,147 have been paid off. Including all Corporation undertakings £1,690,623 has been spent on property, permanent works, &c.; and of this, £493,363 has been redeemed.

Home Office and Lighting Restrictions.—The suggestion that the restrictions regarding lighting are being carried out with unnecessary rigidity at Nottingham was repudiated at a meeting of the Corporation, on Monday of last week, by Sir J. T. M'Craith (the Chairman of the Watch Committee), who said that, with the Town Clerk, he had had an interview a few days previously with one of the principal Home Office officials. They were given to understand that, far from the present arrangements being relaxed, they might be made even more stringent than at the present time. The Chairman pointed out that, if the regulations were ignored, municipalities stood in jeopardy of losing the Government grant towards the support of the police, which in Nottingham amounts to £16,500 a year.

Public Lighting of Yarmouth.—In the course of a discussion, at a meeting of the Eastern Sub-District of the Institution of Municipal and County Engineers, on a paper dealing with "Wartime Economy," a communication was read from Mr. J. W. Cockrill, of Great Yarmouth, who said that £5600 was spent in street lighting in Yarmouth; but the Committee, before the present lighting regulations, reduced this to £4000. The lighting regulations turned out every lamp; but as there were capital charges and repairs to be met, the cost would now be £1500—reducing the bill by £4000. He thought that, as the public had found it possible to live without so much light, it was very likely it would be some years before the lighting bill again reached £5600. Mr. H. Collins remarked that at Colchester the cost of public lighting had dropped from £3578 to £315; and the men had been placed on other work.

Nottingham Water Committee's Responsibilities.—A report relating to the Nottingham Corporation Water Committee's responsibilities as to certain easements over the late Sir Charles Seely's estates, adjoining the Bestwood and Papplewick pumping-station, was dealt with at a meeting of the City Council on Monday of last week, when it was determined to ask the Executors to terminate an agreement under which, for 21 years, the City has been paying £150 annually for a technical trespass on Sir Charles's land in respect of a heading from the Bestwood pumping-station which has been abandoned, and a further £150 annually in regard to a projected heading from the Papplewick station which had never been made. Correspondence which had passed on the subject was read, and in one of the letters the Water Committee pointed out that they had paid £1575 for nothing and £1725 for very little. The Corporation had contributed £5200, which they considered ample compensation for a technical trespass.

Power Gas Corporation.—The operations of the past year show a total profit of £20,743, to which has been added £7479 brought forward from the previous account, making altogether £28,222. Out of this, it is intended to place £1140 to the reserve fund, and to pay a dividend of 6 per cent. per annum upon the ordinary shares, less income-tax. There will remain a balance to be carried forward of £9105.

Water Charges in Manchester.—It is proposed by the Manchester Corporation Water Committee, subject to the approval of the City Council, to increase the charges for water to an extent which will add £29,000 a year to the income of the department. This step is necessitated by the increased rate of interest on loans and the general advance in the cost of labour and materials. The suggestion is to raise the minimum price for the supply of water by meter in the city from 4·85d. to 6d. per 1000 gallons; while outside the city the price is to be raised from 6d. to 8d. It is intended also to reduce the composition allowed on weekly property within or outside the city, of the annual value of £10 and over, from 20 per cent. to 5 per cent. The Committee further propose to reduce the charges for water supplied to local authorities to 5¾d. per 1000 gallons, from 6¾d. as regards Wigan, and 7¼d. in the case of other authorities.

Increased Price Notified at Portsmouth.—The Portsea Island Gas Company announce that, having arranged contracts for the present year's requirements of coal and oil on favourable terms soon after the outbreak of war, the Directors have been able so far to continue the normal price of gas; but in view of the very great increase in the cost of these and all other materials and labour for the coming year, they are now reluctantly compelled to advance the charge. To consumers supplied on the ordinary system, from the date of reading the meters for the current quarter or month, the price will be 2s. 8d. per 1000 cubic feet within the Borough of Portsmouth, and 2s. 10d., 3s. 1d., 3s. 4d., and 3s. 7d. in different out-districts. With regard to consumers on the prepayment system, throughout the district the rebate in respect of gas consumed will be withdrawn on the 31st inst.

Gas Light and Coke Co-Partnership Scheme.—Referring to the co-partnership balance-sheet of the Gas Light and Coke Company to June 30 last, the "Co-Partners' Magazine" remarks that the influence of the war is apparent in the figures. The number of co-partners has declined from 9617 to 9452. Savings added to the withdrawable account have fallen from £6079 to £4419, and to the trust account from £1195 to £391. The price of gas has had to be increased, first to 2s. 8d., and then to 3s. per 1000 cubic feet; and consequently the bonus, instead of being 5 per cent., is at an average rate of 3¼ per cent. But against these results others can be set of a more encouraging character. In broad results, the fund steadily progresses. The interest on bonus and savings in the withdrawable account is larger by £380 than last year; and in the trust account it is larger by £939. The balance of the trust account, added to the amount of stock actually held by co-partners, shows a total of £162,946, as compared with £155,993. This is all to the good.

"CANNON" GAS-HEATED STEAM RADIATORS

FOR

TEMPORARY or PERMANENT HEATING.

Most effective for heating Barracks, Store Rooms, Army and Navy Institutions, Temporary Buildings, &c., &c.

HIGHEST EFFICIENCY.
EVERY SATISFACTION.

Write us for Full Particulars.

The "EQUATOR."

MANUFACTURERS:—

CANNON IRON FOUNDRIES, LIMITED,
DEEPFIELDS, near BILSTON, Staffs.

London Office and Show-Rooms: BATH HOUSE, 57-60, HOLBORN VIADUCT, E.C.

Australasian Agents: MOLDEN & BUDDEN PTY., Ltd., 364A, Little Collins Street, MELBOURNE, Vic., and at SYDNEY, N.S.W.

Coal Famine in Vienna —A Reuter message from Zurich dated last Friday says that, owing to lack of coal, the supply of gas to Vienna is in grave danger of becoming exhausted. The Burgomaster has appealed to the Prime Minister to use his influence in order to enable the municipal gas-works to obtain sufficient coal to avoid the peril of the city being suddenly left in darkness. Laibach is already without light ; the gas-works having no coal.

The Shortage of Copper Coinage.—It has been resolved by the Whickham Urban District Council to send a letter to the Newcastle-on-Tyne and Gateshead Gas Company, asking for more frequent visits to the houses where copper coins are to be found in the prepayment meter boxes. The member who proposed this said he did so "because of the delay in the visits, which was greatly hampering tradespeople through a shortage of copper. Week after week business was practically at a standstill through a shortage of copper."

Cowes Gas-Works Results.—It was stated at a meeting of the Cowes Urban District Council that the gross profit on the gas undertaking for the past half year was £1505; but when principal and interest charges were deducted, there was a deficiency of £93. At the end of the year, it was declared, the ywould probably have a most satisfactory report. One member said he was not at all satisfied with the balance sheet; but another pointed out that the increase in price was of material assistance to them, while they were also making more gas per ton of coal.

Public Lighting Question at Torquay.—At a meeting last Tuesday of the Torquay Town Council, the local Chamber of Commerce forwarded a number of petitions asking for an immediate restoration of the lighting of the town. Petitions were also presented separately by societies and organizations of various kinds. The previous order to reduce the lighting was suspended by an almost unanimous vote of the Council ; and the town will be lighted again as usual. It was explained that the restoration of the former lighting was resolved upon subject to any powers that may be exercised by the military.

Scottish Farmers and Sulphate of Ammonia.—The following remarks are made by the "Scotsman," on the subject of the supply of sulphate of ammonia to Scottish farmers: "The question of the supply of sulphate of ammonia has been brought prominently forward by district agricultural committees in several parts of Scotland. In this connection, it is of interest to note that, according to the Board of Trade returns just issued, the quantity exported during the month of November of this year amounted to 30,500 tons; while in the same month of 1913, which may be regarded as a normal year, the exports amounted to 27,000 tons—showing that the export during the past month has been 3500 tons in excess of the export of a normal year. The country showing the largest increase compared with 1913 is the Dutch East Indies, which took 16,850 tons, against 300 tons in 1913. Surely, in face of these facts, arrangements will be made for a supply of sulphate of ammonia at reasonable prices for spring cultivation. The supply given in November-December at £14 10s. per ton may have been of some use to farmers in the South, but it was absolutely useless for Scotland."

Recent demands by the Bradford Corporation gas workers for advances in wages would mean an extra cost of £7200 per year. The matter has been referred to the Finance Committee.

The Gas Light and Coke Company's collier "Ignis," which carried 3000 tons, has been sunk. She is supposed to have struck a mine on the 8th inst. It is reported that the crew were safely landed.

The Accrington and Stockport Master Plumbers' Associations have lodged protests with the Institute of Plumbers against the practice of the municipalities in those towns supplying and fixing gas appliances.

Several tanks containing creosote oil and naphtha were destroyed by fire last Thursday, at the chemical works of Messrs. James Gibbs and Finch, Limited, Cattedown, Plymouth. The cause of the outbreak is unknown.

The present lighting restrictions should result in Messrs. D. Hulett and Co., Limited, of No. 55 and 56, High Holborn, W.C., experiencing a good demand for their convenient range of japanned tin and cardboard shades for inverted burners. There is a side reflecting shape which should prove particularly useful.

Mr. F. Colburn, of Manchester, has been appointed Gas-Meter Inspector for the City of Birmingham, in succession to Mr. Thomas Spinks. Mr. Colburn has served under Mr. S. Dyson, of the Gas-Meter Testing-Station, Manchester, for seventeen years; and for the past ten years he has held the position of Chief Assistant.

Mr. E. P. Taudevin, of the Richmond Gas Stove and Meter Company, Limited, last week lectured before the Bradford Engineering Society, at the Technical College, on "Gas-Heated Furnaces," illustrating his remarks with lantern slides. He made a special point of the use of gas-furnaces in the steel-works of Sheffield, particularly in the annealing of shells of all kinds.

Messrs. Emmott and Co., Limited, of Manchester and London, have forwarded a copy of the "Mechanical World Pocket Diary and Year Book for 1916." It is the twenty-ninth year of publication of this serviceable little work—the price of which is 6d. net. The contents have been thoroughly revised; and some of the numerous tables have been extended. There is a section on gas-engines; and the Diesel engine on this occasion is separately dealt with. Further information on other subjects has also been introduced.

In regard to the proposed stoppage of works in connection with the duplication of mains between the Nidd Valley and the city, and other water-works extensions, the Bradford Water Committee have decided, in view of the urgent request of the Local Government Board, to stop the works on Wharfe syphon and the construction of intakes at Angram reservoirs, and to undertake that only the most necessary work should be proceeded with till the termination of the war. The Treasury are to be asked to grant authority for the borrowing of a further sum of £96,072; being the difference between money already borrowed and expended, *plus* the approximate amount required up to the end of the present financial year.

For the Efficient Heating

OF MUNITION WORKS, HOSPITALS, LIBRARIES, ETC.

PARKINSON'S "COMPASS" FIRE

being circular, radiates heat in all directions, while the products of combustion are collected by the dome-shaped canopy and conveyed from the room through the central flue in accordance with the Home Office Regulations.

Diam. of Fire, 8½ in. (Equivalent to a 21-in. fire.)

PRICE - £3 0s. 0d.

(Stone Slab and Guard extra.)

The Duplex Burner allows either half or the whole fire to be alight as required.

THE PARKINSON STOVE CO., LTD.,

BIRMINGHAM.

London Showrooms: 129, High Holborn, W.C.

STOCK MARKET REPORT.

THE Stock Exchange has had another quiet week, and the tone on the whole was dull, though different markets were under such various influences that no general description could embrace them all. Abroad, the situation in Serbia and in Mesopotamia was not calculated to impart strength; while at home the growing dissatisfaction in regard to the political aspect, the recruiting campaign, and other matters, indisposed commitments upon anything but a small scale. A pleasing point was furnished by the month's trade returns, which showed an increase in our exports. Home Government issues weakened almost up to the close, when a moderate recovery was welcomed. Home Rails continued weak, relieved only by some demand for the secured issues. Peculiar conditions in Wall Street, where there was much selling, flattened Americans down; and they dragged Canadian Pacifics with them, in spite of the very satisfactory traffics. South Africans were under a cloud; and the good things in the Foreign Market had a set-back. Even shipping and the other plums of the miscellaneous group received a check. Perhaps the attractions of the French loan led to some amount of selling, even of high-class securities. The next British War Loan is not generally expected before the close of the financial year, and large amounts of Treasury Bills are being taken up. Further modification of Stock Exchange regulations was made by the Committee in regard to "physical possession" of securities, thereby facilitating dealings with New York; and measures in regard to commissions were taken to protect members against outsiders. The Banks' commission question will stand over. Business in the Gas Market continued to be on a very light scale. As a general rule, prices did not show much variation (if any) from the figures which have been ruling recently; but some were difficult to understand in the absence of knowledge as to the circumstances attending them. Gas Light and Coke preference one day marked widely divergent figures, and on another Commercial 3½ per cent. changed hands at a higher price than the 4 per cent. The easy condition of the Money Market remained unchanged.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 73½, 74⅜, ditto debenture 62, 62½, 62¾, 63, Imperial Continental 84½, 85, Primitiva preference 3⅜, South Metropolitan 78½, 79. On Tuesday, Continental Union 38⅛, Gas Light ordinary 73⅜, 74, 74¼, ditto debenture 62¼, 62½, 62⅜, Imperial Continental 84, Primitiva preference 3¾. On Wednesday, Gas Light ordinary 73¾, 74, Imperial Continental 84, Liverpool 93½, Monte Video 9 7/16, Oriental 100, Primitiva preference 3 11/16, 3 13/16, Tottenham "B" 96¼, 96¾. On Thursday, Liverpool 93, Monte Video 9 5/16, 9⅜, South Metropolitan 79. On Friday, Gas Light ordinary 73⅜, 74, ditto preference 73, 73½, 75, 75½, ditto debenture 62½, 63, Imperial Continental 83, Oriental 99, 99½, 100, Primitiva 2 15/32, 2½. On Saturday, Commercial 4 per cent. 75, 77, ditto 3½ per cent. 76, Gas Light ordinary 74⅛, Imperial Continental 83, 83½, South Metropolitan 69.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

Messrs. Henry Faija and Co. are, as from the 25th inst., removing their testing works and chemical laboratories to more commodious premises at No. 6, Earl Street, Westminster.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When last Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	8 18 2	..
374,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	8/-	Bombay, Ltd.	5⅛—6⅜	5 17 8	..
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water — 10 p.c.	29—30	5 6 8	..
879,480	10	,,	7	7/-	Bournemouth Gas and Water — B 7 p.c.	15—15½	4 10 4	..
95,000	10	,,	6	6/-	Bournemouth Gas and Water — Pref. 6 p.c.	13½—14	4 5 9	..
147,210	—	—	—	4	Bournemouth Gas and Water — Deb.	..	—	..
880,000	Stk.	Feb. 26	†14	†6/-	Brentford Consolidated	261—266	5 5 3	..
330,000	,,	,,	†11	55/-	Do. New	204—209	5 5 3	..
50,000	,,	,,	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
206,250	,,	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	10½	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	,,	,,	8	7½	Do. A Ord. Stk.	154—159	5 0 8	..
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
130,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
345,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1¼—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	75—77
560,000	,,	,,	5½	46/8	Do. 3½ p.c. do.	103—105	5 1 6	76
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. Stk.	69¼—71½	4 3 11	..
800 000	Stk.	,,	4	4	Continental Union, Ltd.	76—79	5 1 3	3⅛
200 000	,,	,,	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,430	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	6	Derby Con. Stk.	123—126	4 16 0	..
55,000	,,	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17⅛—18	5 11 1	..
16,362,910	Stk.	Feb. 12	1/17/4	42/-	Gas Light and Coke — 4 p.c. Ord.	98—102	4 15 6	73½—74½
2,600,000	,,	,,	3½	3½	Gas Light and Coke — 3½ p.c. max.	76—79	4 8 7	..
4,062,235	,,	,,	4	4	Gas Light and Coke — 4 p.c. Con. Pref.	96—99	4 0 10	73—75½
4,674,850	,,	June 11	3	3	Gas Light and Coke — 3 p.c. Con. Deb.	72½—74½	4 0 6	62—63
130,000	,,	,,	10	10	Gas Light and Coke — 10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16¾	6 11 4	..
86,603	—	—	—	9½	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7⅞	7⅞	Ilford A and C	151—154	5 2 4	..
65,780	,,	,,	6⅝	6⅝	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6	83—85
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
561,000	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. — A	211—213	4 13 11	98—93½
718,100	,,	,,	7		Liverpool 5 p.c. Ord. — B	146—148	4 14 7	
306,083	,,	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	4/-	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne — 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 13 4	9 5/16—9 7/16
1,775,892	Stk.	July 29	4½	4½	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8/2	North Middlesex 7 p.c.	14—15	5 2 8	..
300,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	99—100
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7⅝	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B	128—131	4 19 3	..
100,000	50	,,	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	,,	10	—	Do. D	..	—	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	6 13 4	2 13/32—2½
499,960	5	June 26	5	2/6	,, 5 p.c. Pref.	4⅝—5	5 0 0	3 11/16—3 13/16
521,600	100	June 2	4	4	,, 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	4	,, ,, ,, 1911	..	—	..
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo — 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	San Paulo — 5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 3	..
209,984	,,	,,	10	10	Do. B	222—224	4 9 3	..
523,500	,,	,,	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African	10½—11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/4,0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	78½—79
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	..
209,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 8 5	..
60,000	,,	,,	5	5	Do. 5 p.c. Pref.	110—112	4 9 3	..
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
137,058	,,	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District — A 5 p.c.	135—138	5 8 8	..
742,275	,,	,,	6	6	Tottenham District — B 3½ p.c.	115—117	5 2 7	96¼—96¾
181,255	,,	June 26	4	4	Tottenham District — 4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅜	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	,,	,,	6⅜	63/9	,, B 3½ p.c.	129—134	5 2 7	..
108,075	,,	,,	5/17/8	55/1⅛	,, C 3⅛ p.c.	110—115	5 2 0	..
352,000	,,	,,	6¼	57/6	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	,,	,,	6⅜	63/9	Epsom 5 p.c.	121—126	5 5 2	..
88,416	,,	June 26	3	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

FOR
DRY METERS
TRY
JAMES MILNE AND SON, LIMITED.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, London, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 815 Oldham, and 2412 Hop, London.
Telegrams—
"BRADDOCK, OLDHAM," and "METRIQUE, LAMB LONDON."

"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 171, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

SEND your inquiries for Carburetted HYDROGEN AND BLUE WATER-GAS PLANT, also TAR DEHYDRATING PLANT and other GAS-WORKS APPARATUS to—
BALE AND HARDY,
39, VICTORIA STREET, WESTMINSTER, S.W.

OXIDE OF IRON.
We are in a position to Supply Oxide of Iron promptly, and invite Enquiries.
SPENT OXIDE WANTED.
BALE & CHURCH, LTD.
5, CROOKED LANE, LONDON, E.C.

"TORTO" FIRE CEMENT.
BALE & CHURCH, LTD.
5, CROOKED LANE, LONDON, E.C.

"KLEENOFF," THE COOKER CLEANSER.
Tins for sale to Consumers.
In Bulk for Works Use.
BALE & CHURCH, LTD.
5, CROOKED LANE, LONDON, E.C.